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VOLUME XI APRIL, 1920 NUMBER 4

THE JOURNAL OF
EDUCATIONAL PSYCHOLOGY

# Mental Tests as a Means of Selecting and Classifying College Students

AGNES L. ROGERS

*Goucher College.*

IN March and April, 1919, a series of mental tests was applied to a group of 98 Seniors and 182 Freshmen at Goucher College. The purposes in view were threefold:

(1) to determine their reliability as measures of mental capacity for college women.

(2) to weigh their worth as indices to future academic success.

(3) to establish in the event of their proving satisfactory in the foregoing respects adequate standards both for the selection of candidates for admission and for the classification of entrants in the various divisions of the larger courses, required and elective, in accordance with capacity.

The tests were applied by the writer to both Seniors and Freshmen simultaneously in one large group of three hundred students approximately. The tests were distributed and collected and general supervision was exercised by ten other college instructors.

The Thorndike test of Mental Alertness[1] was used along with the Roger's Interpolation test[2] and the Rogers' Reasoning[2] test. Series A of the former was applied in March and Series K in April. Alternative forms of the other tests were likewise given on the second occasion. The Thorndike Tests are comparable in general character to the Army Scale Alpha. An enumeration of the names of

[1]The Thorndike Mental Alertness Test with instructions for giving and scoring can be obtained from the Bureau of Publication, Teachers' College, Columbia University.

[2]A description of these tests and their method of application and scoring is given in *Experimental Tests of Mathematical Ability and Their Prognostic Value*, Teachers College, New York City, 1918.

the tests included will indicate the extent of similarity between them. They are as follows: the first is a directions' test; the second, a series of disarranged sentences; the third, an arithmetic test consisting of a series of reasoning problems; the fourth, an arithmetic test in the four fundamentals; the fifth, an information test; the sixth, a synonym-antonym test; the seventh, a selective judgment test in which the task consists in indicating which of four things should be done in a given situation or which of four alternatives is the cause of a given course of action; the eighth, an interpolation test; the ninth, an analogies test; the tenth, a test in which the task consists in perceiving and indicating the largest and smallest numbers in a series of columns of numbers; the eleventh, a test in the detection of absurd statements; the twelfth, a test in logical inferences; the thirteenth, a test in the recognition of spatial forms.

These had been applied to candidates for Officers' Training Schools for the Air Service. They also were used as one feature of the Emergency Admission plan of the S. A. T. C. and seemed better adapted a discrimination between higher degrees of ability than the Army Scale Alpha.Their power to determine the mental level of individuals of superior mentality had already been partially demonstrated, and tentative standards for the particular groups examined had been determined. They were, therefore, applied now with the expectation of their proving a reliable means of measuring general mental alertness and aptitude for college work.

Another conspicuous advantage of these tests was that there were available fifteen duplicate copies, genuine alternative forms, equal in difficulty, but differing in content, thus making it possible to repeat the application on generations of Freshmen over a period of years and facilitating the standardizatian of norms for college women. The tests will be re-applied with such improvements as this application suggests at Goucher College, in October, 1919. This article therefore describes only one stage of the investigation, on which further reports will be published later.

Each application of the entire group of tests occupied 45 minutes. The conditions under which the tests were administered, though comparable to those used in applying the tests to candidates for army schools, seemed to the writer to fall short of what the object in view demands. In order to secure reliable measures of individual

ability the groups tested should be smaller. Where three hundred persons are examined simultaneously, the discipline must inevitably become more rigorous and consequently more emotionally disturbing. While it is true that more than merely intellectual functions are represented in the scores derived from tests of intelligence, it is nevertheless desirable that we should approximate as closely as possible to customary examination conditions and accordingly groups not exceeding 50 should be examined together. The reliability coefficients obtained would probably have been greater, if such conditions had prevailed. When calculated by the Pearson method, they were, however, as indicated in Table I.

TABLE I.

| | Seniors | | Freshmen | |
|---|---|---|---|---|
| | r1 | r2 | r1 | r2 |
| Thorndike Test of Mental Alertness, ..... | .76 | .86 | .66 | .80 |
| Rogers Interpolation Test, ..... | .76 | .86 | .75 | .86 |
| Rogers' Reasoning Test, ..... | .54 | .70 | .52 | .68 |

r1 is the reliability coefficient or coefficient of correlation between the two applications of the tests.

r2 is the reliability coefficient for the two applications combined.

$$r2 \text{ equals } \frac{2r1}{1+r1}$$

These coefficients cannot be considered satisfactory, particularly when it is remembered that our ultimate aim is individual measurement. Even if we admit that greater reliability coefficients would result from improved conditions of administration, still a more trustworthy gauge of the capacities tested seems necessary. The very brief period of testing is a partial explanation of the imperfect character of the tests as measuring rods. Their reliability would be increased by merely extending the duration of the time of testing. To determine to what extent these same tests would need to be lengthened to produce reliable results, use was made of the formula suggested by Brown[3], namely $rn = \frac{nr_1}{1+(n-1)r_1}$.

In order to obtain a reliability coefficient of .95, the Thorndike test, if applied under similar conditions, would have to be extended to six times its present duration, that is six of the forms would have to

[3]Brown, William. *The Essentials of Mental Measurement.* Cambridge University Press, Cambridge, 1911. 101-102.

be given and the results pooled to secure such a measure of the student's ability as would yield a reliability coefficient of .95. Similarly for the Rogers' Interpolation, a test six times as long would be required for college women, whereas in the case of High School Girls, examined in smaller groups, a reliability coefficient of .94 was obtained from this test.[4] For the Reasoning test apparently at least sixteen applications would be necesary, although when applied to High School Girls, this test yielded a reliability coefficient of .73.[5] Thorndike's claim that "about 30 minutes of fore-exercise and about 200 minutes of test" is necessary to obtain an individual's true status in comparison with other individuals in a "standard test of intelligence" is supported by our results.[6]

As a measure of academic accomplishment the grades obtained by the students in all courses were averaged. The usual practice is to record these in literal form, the scheme in use at Goucher College being to assign 3 per cent. of the students in both required and elective courses to grade A, 22 per cent. to grade B, 50 per cent. to grade C, while to grades E and F respectively in elective courses 22 per cent. and 3 per cent., and in required courses 15 per cent. and 10 per cent. are assigned. In the Goucher Bulletin it is stated that these letters, A to F correspond with the work frequently described as excellent, good, average, poor, conditioned and failed. In the case of an F grade, the course in question must be repeated. An E grade indicates that certain work remains to be completed. If a student fails to remove a condition on a course by the time set, she is regarded as having failed in that course. In converting these literal measures into numerical terms it was decided to have one system of grading for both required and elective courses, to count all conditions that were later removed as D and all unremoved conditions as F. In this way were obtained for Senior and Freshman measures of their accomplishment in academic work. For the Seniors, the academic mark represents the composite result of approximately 30 separate grades and for the Freshmen 4-6 grades.

---

[4]ROGERS, AGNES L. *Experimental Tests of Mathematical Ability and Their Prognostic Value.* Teachers' College, Columbia University, N. Y. City, 1918. p. 45.

[5]ROGERS, AGNES L. *Experimental Tests of Mathematical Ability and Their Prognostic Value.* Teachers' College, Columbia University, 1918, p. 45.

[6]THORNDIKE, E. L. *Tests of Intelligence, Reliability, Significance, Susceptibility to Special Training and Adaptation to the General Nature of the Task.* School and Society IX, 216. February 15, 1919.

To determine the extent to which the test results are symptomatic of academic attainment, two methods were used. First, the degree of correspondence between the two sets of measures obtained from the tests and from averaging academic grades was calculated. Secondly, the extent to which students maintain their place in certain divisions of the group in the two sets was computed. Pearson coefficients of correlation are presented in Table II, which reveal the amount of interrelation between the tests and college marks.

TABLE II.

| | Academic Success | | | |
|---|---|---|---|---|
| | Seniors | | Freshmen | |
| | r | P. E. | r | P. E. |
| Thorndike Test of Mental Alertness Series A, | .42 | .056 | .37 | .043 |
| Thorndike Test of Mental Alertness Series K, | .39 | .058 | .37 | .043 |
| Thorndike Test of Mental Alertness Series A and K, combined, | .43 | .054 | .40 | .040 |
| Rogers' Interpolation 1, | .36 | .059 | .41 | .040 |
| Rogers' Interpolation 1a, | .31 | .061 | .29 | .050 |
| Rogers' Reasoning 1, | .21 | .065 | .23 | .048 |
| Rogers' Reasoning 1a, | .20 | .065 | .12 | .050 |

It is clear from these coefficients that the independence of the functions measured by the Mental Alertness and the Interpolation tests and by college marks is substantial. Between the Thorndike tests and academic grades the coefficient obtained is at least eight times the amount of the probable error and for the Interpolation tests it is not less than five times. As the shortness of the period of testing for the individual tests was believed to lower their reliability and this would tend to decrease the coefficients of correlation between tests and academic grades, various combinations of the tests were made after the manner suggested by Woodworth[7] and the amount of correspondence between these composites and college marks was computed for the Seniors. These are presented in Table III.

TABLE III.

| | Academic | Success |
|---|---|---|
| | r. | P. E. |
| Thorndike Test of Mental Alertness Series A and K combined, | .43 | .05 |
| Thorndike Test of Mental Alertness A and Rogers Interpolation 1 combined, | .43 | .05 |
| Thorndike Test of Mental Alertness K and Rogers' Interpolation 1a combined, | .90 | .01 |
| Thorndike Test of Mental Alertness A and K and Rogers' Interpolation 1 and 1a combined, | .43 | .05 |

[7]Woodworth, R. S. *Combining the Results of Several Tests.* Psychological Review, XIX: 97.

With the exception of the composite obtained from the Mental Alertness Test K and Interpolation Test 1a these new composites yield coefficients but little larger than the Thorndike tests alone. Where the correlation obtained is so small, it would be unpermissible to use the method of the regression equation to predict even *on the average* future performance at college from achievement with the tests, much less the *individual's* probable status. The standard error made in using the regression equation to estimate academic success from mental performance, when Series A and K of the Thorndike Test are combined is in the case of the Seniors .45. The total range in academic grades for the Seniors is 2.13. This means that the probable error of our estimate is approximately one-fifth of the difference betewen the best and the poorest Senior. Since practical certainty is attained only between limits of 4 or 5 P. E., which in this instance covers the entire range almost, we cannot rely upon the tests as measuring instruments of individual promise of college students.

When we represent graphically the correlation between the Mental Alertness Test, Series A and K combined and College Marks as in Figures 1 and 2, this becomes very apparent. The wide variability in academic success corresponding to any particular degree of achievement in the tests is obvious.

The limitations of the tests as indicators of academic success are even more striking when we use the second method and consider the median, tertile, and quartile retention. The percentage of students retaining their place in the same halves of the distribution is shown in Tables IV and V, which indicate roughly the amount of displacement existing. Evidently we would have been wrong four times out of ten, if we had used the tests to predict academic success even so roughly as this classification implies.

TABLE IV
Median Retention of Seniors.
Academic Success.

| Mental Alertness Test, A and K | 1 | 2 |
|---|---|---|
| 1 | 29 | 20 |
| 2 | 18 | 31 |

Median Retention=60 or 61.2 per cent.

TABLE V
Median Retention of Freshman.
Academic Success.

| Mental Alertness Test, A and K | 1 | 2 |
|---|---|---|
| 1 | 56 | 34 |
| 2 | 35 | 57 |

Median Retention=113 or 62 per cent.

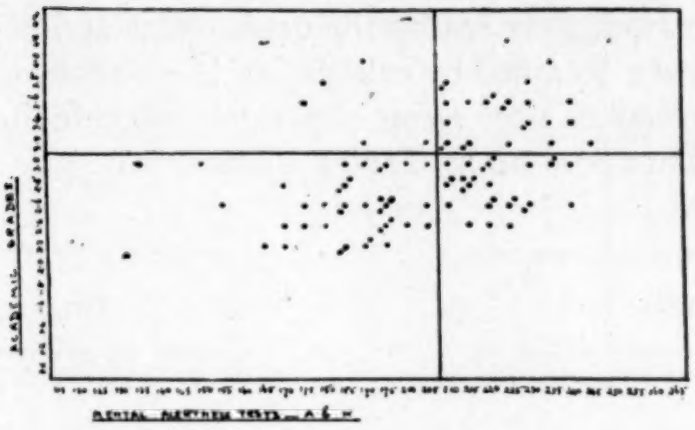


FIGURE 1

Scatter diagram showing the relation between the scores obtained by the Seniors in the Mental Alertness tests, Series A and K combined and their academic grades.

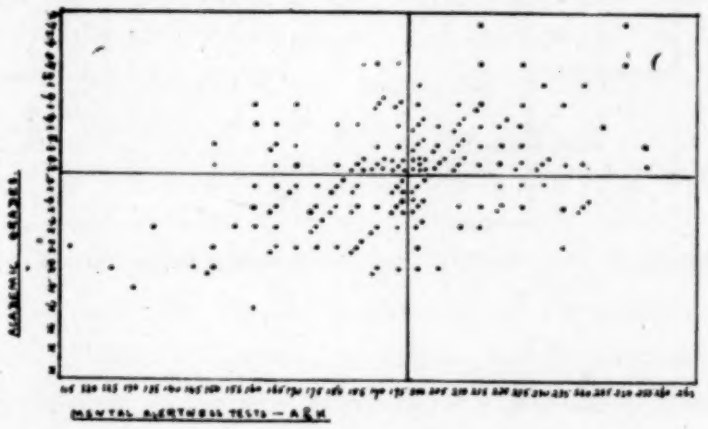


FIGURE 2.

Scatter diagram showing the relation between the scores obtained by the Freshmen in the Mental Alertness tests, Series A and K combined and their academic grades.

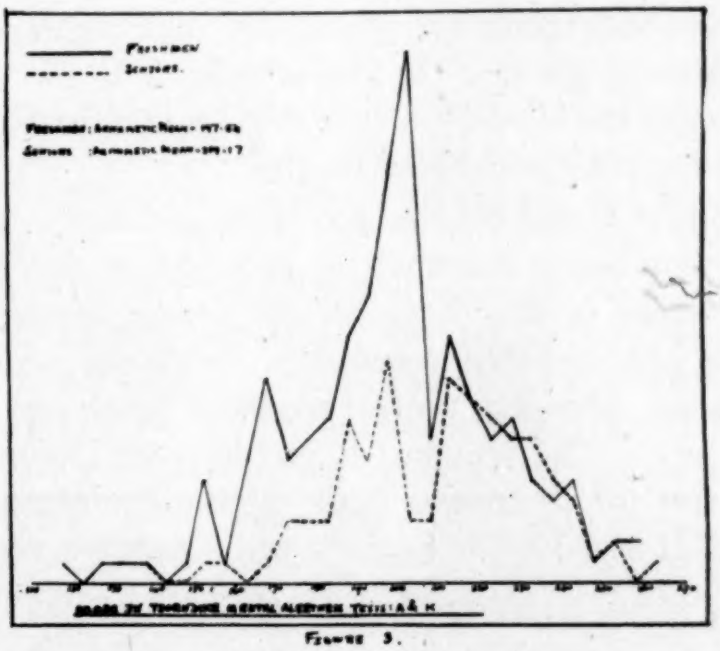


FIGURE 3.

This result is emphasized by the more exact and detailed analysis of the same data obtained by calculating the actual number and percentage of students occupying the same quartile in both sets of measures. This is done in Tables VI and VII.

**TABLE VI.**

**Quartile Retention of Seniors. Academic Success.**

| Mental Alertness Test, A and K | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 1 | 12 | 7 | 3 | 3 |
| 2 | 5 | 7 | 9 | 4 |
| 3 | 4 | 7 | 5 | 7 |
| 4 | 3 | 3 | 8 | 11 |

**Quartile Retention=35 or 35.7 per cent.**

**TABLE VII.**

**Quartile Retention of Freshman. Academic Success.**

| Mental Alertness Test, A and K | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 1 | 16 | 13 | 9 | 7 |
| 2 | 13 | 14 | 12 | 7 |
| 3 | 11 | 13 | 10 | 11 |
| 4 | 5 | 6 | 11 | 24 |

**Quartile Retention=64 or 35.1 per cent.**

To predict an individual's probable status in academic work from his performance in the tests would obviously be rash. In this instance we would have erred in such a rough approximation to measurement as assigning a student to a definite quartile, sixty-five times in every hundred in the case of both Seniors and Freshmen. It is not even true that students in the highest quartile in college scholarship records never get into the lowest quartile in the test results nor that students in the lowest quartile in college records never get into the highest quartile in the test results.

A division of larger classes into three sections is not only more customary, but better justified on grounds of the distribution of mental capacities in the form of the normal frequency curve, in which there is observable a tendency to cluster around one type, small deviations from that central tendency being frequent and large deviations rare. The amount of tertile retention has therefore a special interest for us from a practical standpoint and is presented in Tables VIII and IX for Seniors and Freshmen respectively.

TABLE VIII
Tertile Retention of Seniors.
Academic Success.

| Mental Alertness Test, A and K | 1 | 2 | 3 |
|---|---|---|---|
| 1 | 18 | 8 | 6 |
| 2 | 10 | 12 | 11 |
| 3 | 4 | 12 | 17 |

Tertile Retention=47 or 47.9 per cent.

TABLE IX.
Tertile Retention of Freshman.
Academic Success.

| Mental Alertness Test, A and K | 1 | 2 | 3 |
|---|---|---|---|
| 1 | 34 | 13 | 13 |
| 2 | 25 | 19 | 18 |
| 3 | 13 | 17 | 30 |

Tertile Retention=88 or 45.6 per cent.

In this classification likewise we would be in error in 52 per cent. of the cases as far as the data derived from the Seniors are concerned and in 54 per cent. of the cases as shown by the results obtained from the Freshman. Speaking roughly we can state that every other assignment would have been an unwarranted assignment.

That these Mental Alertness tests requiring only an hour of time have some value, however, for purposes of classifying students in accordance with capacity as seen from a comparison of these results with those that are to be expected by mere random assignment of students to sections. By the latter method we have one chance out of two of assigning a student to the correct half of the group, one out of three of assigning her to the correct tertile and one out of four of assigning her to the correct quartile. The corresponding chances, where we make use of the Mental Alertness tests, Series A and K combined, employed in this investigation are approximately three out of five, two out of five and one out of two. To appraise adequately the practical value of the tests we would have, however, to compare their power to classify with that of the previous school record.

There are of course many reasons why perfect correspondence between ability as measured by the Mental Alertness tests and ability as measured by college grades should not be found. One obvious cause of the low correlation is that we are here dealing with a selected group, from which presumably those unfit to profit by college study have largely been eliminated. The Seniors have certainly

passed through a prolonged winnowing process. A comparison of the distributions for Seniors and Freshmen presented in Figure 3 gives evidence in support of this. It will be noted that the group average for Freshmen is less than that for Seniors and that the range towards the low end of the scale is greater for the former than the latter. Only 26.3 per cent. of the Freshmen reach or exceed the median for the Seniors. This may be partly due to chance errors of measurement, but it also indicates a constant cause at work, namely the elimination of the weaker students during the four years of the college course. The fact that both groups represent a selection of college candidates justifies the statement that the actual correspondence between success with the tests and academic promise is higher than the coefficients of correlation presented in Tables II and III indicate.

Furthermore it is obvious that the mental abilities underlying the two sets of measures—those derived from the tests and those based on academic records are not identical. The tests gauge predominately innate intellectual dexterity, whereas college marks rather furnish measures of progress in learning, into which there enter to a very great extent emotional and moral elements. The conscious possession of purposes and the degree to which they dominate the mind are powerful factors in determining academic success. The extent to which the student identifies herself with the college classwork is as essential an element in the grades she receives as the intellectual acuity or skill she possesses. It has to be admitted that the mental tasks demanded by these tests are humble. Given sufficient time college women could master all of them readily. The emphasis is on speed rather than on difficulty and in so far as this is true they fall short of providing an ideal gauge of intellectual power. While well adapted to younger or less carefully selected individuals, they are, it would seem, too simple for use in classifying students on the basis of mental capacity. There is a general law that the harder the test, the greater is the scatter. The weak fall more conspicuously and the able succeed more markedly. To distinguish between the higher levels of intelligence we need therefore harder tests, involving more searching intellectual tasks.

Moreover, as has already been pointed out, the tests used in this investigation do not measure with sufficient accuracy the traits

they gauge. Their reliability coefficients show to what extent they fail in this respect. It is equally true that academic grades are imperfect, by no means determining exactly the abilities they purport to measure. It has to be borne in mind that college marks are not assigned to all students by the same instructors even in the same subjects of study and despite the standardization of grades secured by the use of a defined sysetm, such as the Missouri system of grading, still misplacements are likely to occur. Students are graded by different instructors in different years and this tends to lower the accuracy of the ratings made and so far these compare unfavorably with the tests.

Certain capacities essential in academic work are undoubtedly measured by the tests and in spite of their defects they can be of service in two respects. In the first place they are superior, even if only slightly so, to haphazard guessing as a basis for allocating students to sections on grounds of mental capacity. Using Series A and K combined of the Mental Alertness test we have roughly one chance in two of making a proper assignment, whereas by haphazard selection we have but one chance in three. In the second place, they are of value in determining a lower limit, which when coupled with all the other information about an applicant to which the college has access, can reinforce a judgment as to fitness to undertake a college course. Thus it is practically certain that a student failing to attain a score of 125 in Series A and K combined lacks the ability that college work demands and should be discouraging from entering. Her efforts would be applied to better effect in other pursuits.

This investigation points to the directions in which the tests are susceptible of improvement. The period of testing must be lengthened. More capacities and more fundamental capacities should be measured. The student must be confronted with more subtle problems and more intricate tasks, so that intellectual power rather than speed is emphasized in the scores obtained. Smaller groups should be measured simultaneously so that the conditions of application are as normal as possible. Provided such improvements are made, the tests give promise of being a helpful supplementation of existing methods of selecting college entrants.

The need for a more satisfactory method of determining fitness to pursue a college course is great. Changes in College Entrance Ex-

aminations, notably by four of the colleges for women, have led to renewed interest in the problem. Columbia and other colleges for men have recently adopted psychological tests. It would seem incumbent that this new instrument should itself be carefully tested before it is accepted as the nonpareil and the satisfactory solution of a difficult situation.

# Students' Methods of Studying a Certain Subject —Psychology

L. W. Webb

*Northwestern Universitty.*

## I. Introduction.

IN AN endeavor to discover students' methods of studying, one should bear in mind that it is erroneous to assume that a student in high school or college has general habits of studying, or that he applies the same methods of attack to each of the various subjects he happens to be carrying. It would be very valuable information if we knew which methods are best for general habits of studying and which are best suited to each of the different subjects. One procedure that might secure such knowledge would be to investigate the study habits of students in a number of subjects, and then to note those methods common to all of the subjects, as well as those peculiar to each. This would be a rather laborious task. Perhaps a better way would be to have groups of students use various methods of study in the different subjects, making sure that the technique provided for a control sufficient to measure adequately the results.

In the study here reported the problem was two-fold: 1st, to discover the habits of attack students were using in the course in Elementary Psychology, and second, to determine whether or not there was a difference in the methods of study employed by the good students and by the poor students; and, finally, whether the superior work of the good students was wholly dependent upon native ability, or in part upon superior methods of study.

During the fall semester of the academic year 1916-17 at Northwestern University there were six sections in Elementary Psychology with an enrollment of between 275 and 300 students. Two of the sections were conducted by the writer, the others were in charge of three instructors. The instructors were greatly interested in the problem and co-operated fully in gathering the data, for which I here acknowledge my indebtedness.

The following questionnaire was used in this investigation:

QUESTIONNAIRE ON METHODS OF STUDYING

Name ..... Date .....

I. Instructions.

PLEASE READ AND FOLLOW INSTRUCTIONS CAREFULLY

1. Write your name and the date at tthe top of the page.
2. The purpose of this questionnaire is to discover your *habitual* methods of study. Answer every question with this idea in mind.
3. Answer each question, as far as possible, with "yes" or "no."
4. The answers will in no wise affect your standing in this or other courses.
5. Answer each question according to *facts* or this will be scientifically worthless.

II. Questions.

1. Do you in any way review the previous class work before beginning the study of the new assignment? ..... If so, is it by reading the assignment ....., by study of lecture notes ....., or by study of outline of the text.....?
2. On the average, how much time do you give to preparation for each class exercise in .....? .....?
3. Do you usually read the assignment once, twice, or three times .....?
4. Do you go over the assignment thoroughly and in detail the first time you read it? .....
5. Do you first read the assignment rapidly as a whole and then go over it later more slowly and get the details? .....
6. Do you outline the assignment in writing? .....
7. Do you pick out what you regard as the important features of the assignment mentally ....., or in writing? .....
8. Do you frame possible questions that might arise in the class room? .....
9. Do you take full, or brief organized class notes, ..... or no class notes? .....
10. Do you simply jot down notes in unorganized form what you regard as the most important features of the lecture? .....
11. Do you reorganize or work over your lecture notes outside of class? .....
12. Do you do all of your studying of one subject at one sitting? .....
13. Do you regularly follow a plan of distributing your time spent on one subject over more than one period? .....
14. After studying an assignment, do you usually try to think it out from memory before class time? .....
15. Do you have a specific time for the study of each subject? .....
Do you usually follow this plan? .....
16. Do you have a definite place ....., or places for study? .....
..... Or do you study at a variety of places depending upon conveniences of each day? .....
17. In preparing for tests or examinations, do you read the entire text over carefully .....; simply study outline of text .....; or lecture notes only .....? If you use more than one, which are they? ..... and to which of these do you pay more attention? .....
18. Is it your custom to prepare for an examination in one day or one night, ..... or do you extend the period over several days or nights? .....

The filling out of the questionnaire was supervised by the writer in each of the sections. The students were informed of the purpose of the investigation. I told them I wanted to know only the methods of studying they employed in dealing with Psychology, and they were asked to keep that in mind in answering each question. The necessity of carefully following the instructions were urgently impressed upon each class. The instructions were read aloud; then each question was repeated aloud and the students were requested to answer the question as soon as we had finished reading it.

In preliminary explanation, these points should be brought out. The questionnaire method is open to criticism, but at the present time I am unable to conceive of a method whereby we may discover students' methods of studying without asking them. The reliability of the answers may be questioned. Owing to the precautions we exercised, the students were fully aware that nothing was to be gained by misrepresentation; hence I am of the opinion that our results are as near the truth as one could expect. The form of the questionnaire may be criticised: there may be too many questions: perhaps one should confine the investigation to the daily preparation and omit the questions dealing with examinations. However, there may be variations well worth knowing. It is possible that we might have obtained better results had we studied the two problems separately. Many of the topics are weighted with subheads; more concise questions may be the better method. Probably the most severe criticism to be made has to do with our method of determining which are good and which are poor methods of studying. We arbitrarily assumed certain methods to be good. while others were classed as poor. Of course we took into consideration the experimental results upon learning, also the opinion of others such as is found in Whipple's "How to Study Effectively;" Kitson's "How to Use Your Mind," and others.

## II. Results.

We tabulated* the number of students answering each question. These figures range from 183 to 246. All the questions were answered by more than 200 students except in the case of one question, which had only 183 answers. The record of the number of

*I am indebted to one of my advanced students, Miss Ruth Neal, for much assistance in the tabulation.

students answering "yes," and the number answering "no" was kept separately for each question. We then figured the percentage that these latter numbers were of the total number answering each quesion. We have consideerd only the positive results in this paper.

A. *The Percentage of All Classes of Students Employing Various Methods of Studying.*

The statistical data for the above topic will be found in Tables 1 and 2. Table 1 gives the percentage of the entire group employing the good methods, while in Table 2 the percentages are stated with reference to the poor methods. It will be noted that we have divided each table into two groups for the purpose of indicating the methods employed in daily preparation and also those used in preparing for an examination. Thus, of the good methods, we have fifteen for daily preparation and three for examinations, while of the poor methods we have four and two in the respective divisions. We have numbered the methods in the order in which they were found in the questionnaire. The numbers in parenthesis after each method indicates its number in the questionnaire; thus Review (1) indicates that by referring to the questionnaire, the first question is found to request the student to state whether or not he reviews the preceding lesson before beginning the study of the new assignment.

TABLE I. PERCENTAGE OF THE WHOLE GROUP EMPLOYING GOOD METHODS.

DAILY PREPARATION.

| | | |
|---|---|---|
| 1. | Review (1), | .52 |
| 2. | Hour Plus (2), | .59 |
| 3. | Read Assignment Twice (3), | .40 |
| 4. | Details Second Reading (5), | .33 |
| 5. | Outline Assignment (6), | .27 |
| 6. | Important Features Mentally (7), | .60 |
| 7. | Important Features Writing (7), | .70 |
| 8. | Raise Possible Questions (8), | .40 |
| 9. | Brief Class Notes (9), | .55 |
| 10. | Full Class Notes (9), | .43 |
| 11. | Reorganize Lecture Notes (11), | .25 |
| 12. | Distributed Effort (13), | .25 |
| 13. | Recall Before Class (14), | .38 |
| 14. | Regular Time (15), | .50 |
| 15. | Regular Place (16), | .56 |

PREPARATION FOR EXAMINATION.

| | | |
|---|---|---|
| 1. | Lecture Notes and Text (17), | .91 |
| 2. | Emphasize Lecture Notes (7), | .69 |
| 3. | Distributed Effort (18), | .60 |

TABLE 2. PERCENTAGE OF THE WHOLE GROUP EMPLOYING POOR METHODS.

| | | |
|---|---|---|
| | DAILY PREPARATION. | |
| 1. | Read Assignment Once (3), ..... | .58 |
| 2. | Details First Reading (4), ..... | .70 |
| 3. | Unorganized Class Notes (10), ..... | .25 |
| 4. | Massed Effort (12), ..... | .70 |
| | PREPARATION FOR EXAMINATION. | |
| 1. | Emphasize Text (17), ..... | .31 |
| 2. | Massed Effort (18), ..... | .40 |

## 1. *Good Methods.*

*Daily Preparation.* An examination of Table 1 reveals the fact that of the fifteen good methods here listed, only seven are employed by more than fifty per cent. of the students. Of these seven, six are employed by from fifty and sixty per cent., and one by seventy per cent. The latter is the picking out of the important features in writing. Under this question the students were allowed to answer "yes" if they underscored the text. This seems to be a prevalent habit. However, we must recognize that this practice can easily become of no value by the underscoring of too much of the text. On the other hand, eight of the good methods are practiced by less than fifty per cent. of the students. Of these eight methods three are used by from forty to fifty per cent., two from thirty to forty, and three below thirty per cent. Two of the fifteen methods, recall and distributed effort, have been proved superior by experimental results. These are used by only thirty-eight and twenty-five per cent. of the students, respectively.

*Preparation for Examination.* All three of the methods mentioned in this division have a score of sixty or above, one attaining a score as high as ninety-one. No other usage is so prevalent among all the students.

*Conclusion.* We are forced to conclude upon the basis of the above analysis that the majority of the good methods for daily use are not found to be among the study habits of the majority of the students. Better habits of study are employed by the larger number of students in preparing for an examination than is the case in preparing for the daily class exercise.

### 2. *Poor Methods*

*Daily Preparation.* In Table 2 there are listed four methods under this caption. Of these four methods one has the score of fifty-eight and two reach the high mark of seventy, while one goes as low as twenty-five. It will be noticed that massed effort, the one method experimentally proved to be poor, is practiced by seventy per cent. of the students.

*Preparation for Examination.* Of the two methods here presented, each is employed by forty per cent., or fewer, of the students. One outstanding feature is the decrease in the number of students who use massed effort in preparing for their daily work, as compared with those who employ the same method when preparing for examinations.

*Conclusion.* It is quite evident that the conclusion to be reached from a study of these data is that the larger number of poor methods is in daily use by a majority of the students. In the case of examinations the reverse is true.

### 3. *General Tendency of the Group*

From a study of the data in Tables 1 and 2 when they are combined, it appears that the general tendency of the group is not to practice good habits of study, since the weight of the evidence is in the opposite direction. Forty per cent. of the students do not put into practice eighty-three per cent. of the good methods, fifty per cent. of them do not habitually employ fifty per cent. of these methods, while sixty to seventy-five per cent. confess that they do not employ thirty-nine per cent. of the good methods. On the other hand, from forty to seventy per cent. of the students confess that they use sixty-six and two-thirds per cent. of the poor methods. Considering the evidence, we believe that we are justified in concluding that the majority of the students lack good habits of studying Elementary Psychology.

## B. *A Comparison of the Study Habits of Good and Poor Students.*

The second problem growing out of this investigation is to discover, if possible, whether the good students have better habits of

study than the poor students. The good and the poor students were determined by the grade received in the course in Elementary Psychology. The grades at Northwestern are: A, B, C, D, E and F. All the students receiving the grade of A were classed as good students; these we have entitled the A group. Students obtaining the grade of D or lower were said to be poor students and these we have called the D group. The A group has in it 39 students and the D group is made up of 33 students. Both men and women are in each of the groups. We have figured the percentage of students in each group that answered "yes" to the various questions. These figures are given in Tables 3 and 4. Table 3 gives the percentages of the two groups employing good methods, while in Table 4 will be found the percentage of students in the A and D groups practicing poor methods of studying. The numbers in parenthesis are for the same purpose as indicated in Tables 1 and 2. We have again divided the data according to daily work and preparation for examination.

### 1. *Good Methods.*

*Daily Preparation.* A study of the data in Table 3 reveals the fact that in ten of the fifteen methods under daily preparation the A group has a larger score; a larger percentage of the D group uses four of the methods and in one instance the two groups are tied. A better comparison is obtained if we consider the differences in the scores of the two groups. The differences in favor of the A group range from 2 to 24; eight of the differences are above 11; the average is 12.5 and the median is 13.5. The range of the differences in favor of the D group is from 2 to 6; the median is 4.5 and the average is 4.25.

*Preparation for Examination.* There are only three methods under this heading. A large percentage of the D group uses two of the methods leaving only one in favor of the A group. This one which has a greater number of A's has a difference in its favor of 23; the other two have differences of 1 and 16.

*Conclusion.* In doing their work from day to day, the A students have presented the preponderance of evidence to prove that they employ the better methods of study. The evidence as concerns examinations is more evenly divided, the two groups have practically the same score for one method; as concerns the other two methods

TABLE 3. PERCENTAGE OF STUDENTS IN THE A. AND D GROUPS EMPLOYING GOOD METHODS.

| | | A | D |
|---|---|---|---|
| | DAILY PREPARATION. | | |
| 1. | Review (1), | .51 | .56 |
| 2. | Hour Plus (2), | .76 | .64 |
| 3. | Read Assignment Twice (3), | .42 | .42 |
| 4. | Details Second Reading (5), | .35 | .31 |
| 5. | Outline Assignment (6), | .23 | .29 |
| 6. | Important Features Mentally (7), | .69 | .55 |
| 7. | Important Features Writing (7), | .64 | .51 |
| 8. | Raise Possible Questions (8), | .50 | .26 |
| 9. | Brief Class Notes (9), | .56 | .58 |
| 10. | Full Class Notes (9), | .44 | .42 |
| 11. | Reorganize Lecture Notes (11), | .11 | .00 |
| 12. | Distributed Effort (13), | .29 | .16 |
| 13. | Recall Before Class (14), | .37 | .41 |
| 14. | Regular Time (15), | .66 | .45 |
| 15. | Regular Place (16), | .72 | .61 |
| | PREPARATION FOR EXAMINATION. | | |
| 1. | Lecture Notes and Text (17), | .90 | .91 |
| 2. | Emphasize Lecture Notes (17), | .79 | .56 |
| 3. | Distributed Effort (18), | .48 | .64 |

TABLE 4. PERCENTAGE OF STUDENTS IN THE A AND D GROUPS EMPLOYING POOR METHODS.

| | | A | D |
|---|---|---|---|
| | DAILY PREPARATION. | | |
| 1. | Read Assignment Once (3), | .52 | .58 |
| 2. | Details First Reading (4), | .73 | .69 |
| 3. | Unorganized Class Notes (10), | .22 | .45 |
| 4. | Massed Effort (12), | .62 | .76 |
| | PREPARATION FOR EXAMINATION. | | |
| 1. | Emphasize Text (17), | .21 | .44 |
| 2. | Massed Effort (18), | .52 | .36 |

each group has one in its favor, but the larger difference is on the side of the A's. However, the relative value of the two methods is of vital importance, as it is throughout the entire comparison, and of this fact we have no positive proof. Hence, we conclude that the A students are much more in the habit of putting into practice in their daily work the good methods. As concerns examinations, the evidence does not justify a positive conclusion.

### 2. *Poor Methods.*

*Daily Preparation.* The scores for three of the four methods listed under this topic indicate that they are practiced by a larger percentage of the D group. In the one method having a larger

per cent. of the A's the difference is only 4, while with those practiced by more of the D's, the range is from 6 to 14 and the average is 14.3.

*Preparation for Examination.* As in the instance of the good methods, the two groups are more evenly divided. Of the two methods employed for this purpose each group has the higher percentage in one instance. In the matter of the difference, the score of the A's is 16, while that of the D group is 23.

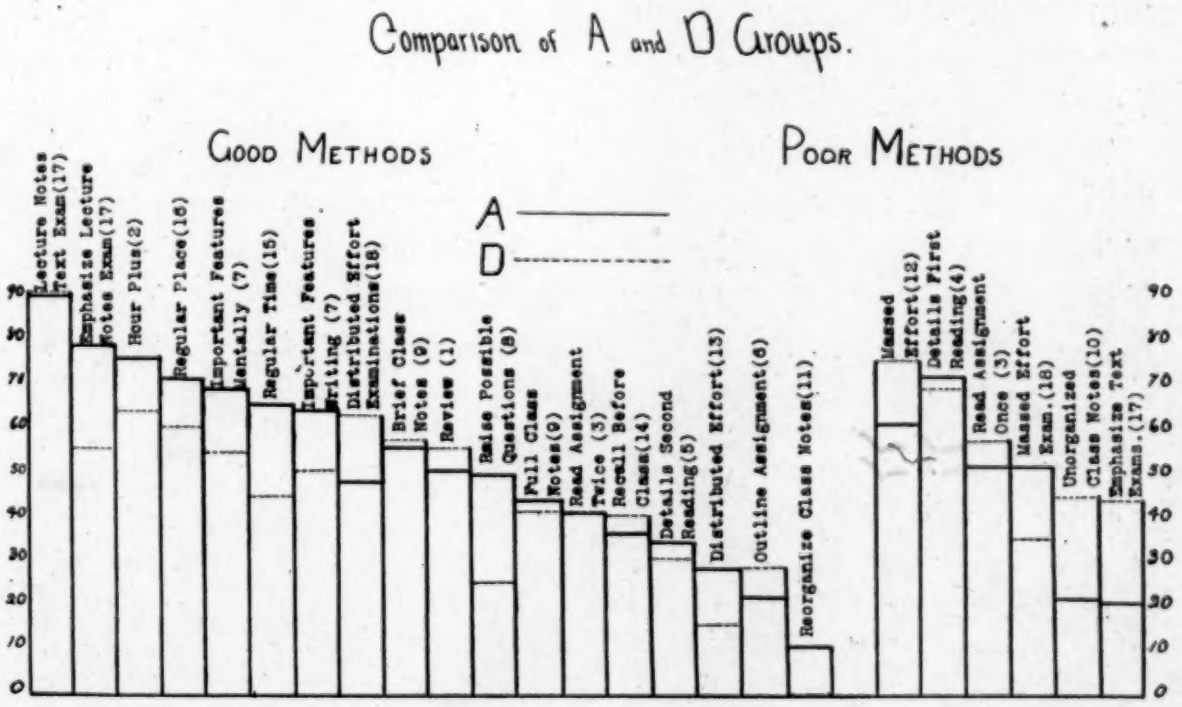
*Conclusion.* Our data justify the conclusion that the poor methods of study are more widely used by the D students. This is certainly true in regard to daily work; the majority of the methods are daily employed by the larger percentage of the D's. For examination the evidence is only slightly in favor of the A students.

3. *A More General Comparison of the Two Groups.*

For the purposes of this comparison we have combined the data of Tables 3 and 4. All of the good methods have been placed in one group, likewise all of the poor methods.

*Good Methods*

Of the eighteen good methods eleven are more frequently employed by the A students; a larger percentage of the D group use six of the methods, and both groups have the same percentage in one



instance. By computing the differences of the scores for the two groups, we discover that these range from 2 to 24 in the case of the A group; all but two of them are above 11. The average is 13.45 and the median is 13. Of the six cases wherein the D students excel, the differences range from 1 to 16, five of them are not above 6, while the average is 5.66 and the median is 4.50.

### *Poor Methods.*

We have under this heading six methods, four of which are more generally employed by the D group, leaving only two wherein the A's excel. The differences are again significant. Those in favor of the poor students range from 6 to 23, with an average of 16.5; the two differences for the A students are 4 and 16, giving an average of 10.

### *Conclusions.*

The methods we have designated as good are more widely used by the A students. In other words the larger percentage of the better students regularly use a greater number of the good methods than do the D students. The reverse is true in the case of the poor methods; the majority of the methods are favored by the D group while the differences in the percentages of the two groups using these methods are greater on the side of the poorer students. Hence we conclude that the A students have better methods of studying than do the poorer or D students.

There is a positive correlation between the two groups. The methods were ranked according to the percentage of students in each group practicing them; thus the one having the highest percentage was ranked first, and the others in order. The rank-difference formula was used. The computation yielded an index of correlation of .81 for the good methods and .70 for the poor methods. This simply means that there is a rather strong tendency for the same methods to be favored by the two groups; i. e., if a method is popular with the good students it is likely to be frequently used by the poor students. In other words, that method employed by a large percentage of one group is likely to fare similarly with the other group. This matter of correlation in no way invalidates

the preceding conclusion. The differences in the percentage scores of the two groups are the more significant data.

## III. Summary of Conclusions and Discussion.

Upon the basis of the foregoing study we have been able to make the following conclusions:

### 1. *Concerning the entire group of students.*

Our results have shown that in preparing for the daily class work the majority of the good methods of study are not regularly employed by the larger number of students; on the other hand the greater percentage of the poor study methods is practiced by a majority of the students.

Somewhat better conditions were found as concerns the habits of the students in preparing for examinations. The majority of the good study habits was generally practiced by the larger group of the students, while the minority of the students confessed to using poor methods of study. The students on the whole seem to be wiser in regard to examinations than they are in their daily work.

When we considered both the good and the poor study methods in one group, we were forced to conclude that the general tendency of the majority of the students is to practice poor methods of work in their study.

### 2. *Concerning the good and the poor students.*

The A students gave evidence that they were much more in the habit of employing in their daily work, the larger percentage of the good methods of study; the minority of this group were found to be daily practicing the poor study methods. The reverse condition existed with the D students. Hence, we concluded that the good students possess better daily study habits than do the poor students.

The contrast was not so striking in regard to preparation for an examination. However, the evidence was slightly in favor of the A students in this instance, thus forcing the conclusion that the better students tend to have the better study habits in preparing for an examination.

By grouping the evidence under one heading, the case in favor of the good students is strengthened. The preponderence of the evidence was in favor of the good students. The conclusion is that there exists on the whole, a very strong tendency for the better students to practice good habits of study, while the poorer students generally lacked these good habits, and were rather inclined to favor the usage of poor methods.

3. *Concerning the matter of correlation.*

A rather high positive correlation was shown to exist between the methods, both good and poor, employed by the A and the D students. This simply means that that method, whether good or poor, that was used by one group was likely to be in favor with the other group. This in no way invalidates the conclusions we have made in comparing the two groups of students. The difference in the percentage of each group employing the various methods is the significant evidence to be considered, and the correlation here referred to does not affect this point.

There are one or two practical applications of the above results that need to be considered. This investigation indicates clearly that the study habits of the majority of students are merely picked up. It has been largely a matter of chance as to which methods have been employed. While our questionnaire did not have a question that would indicate the source of the study habits of the students, I am assuming that since the lack of generally good methods was so prevalent that the students, had they known the difference, would have been wise enough to choose the better ones. This argues strongly for more general instruction in how to study. It must be remembered that these students came from a large number of high schools scattered over a wide territory. This would indicate that it is not generally the custom of high schools to instruct their students in the best methods of attacking the problems arising out of the effort to master the various subjects of the curriculum. It will be recalled that the students from whom these data were gathered were sophomores, juniors and seniors in college. If these students, thus far advanced, have done such a poor job of building up study habits, what should we expect in the high school? Conditions equally as bad or worse would probably be found, for the

younger the student the less mature the experience and judgment, and hence the smaller his ability to criticise and remedy his own methods of work. No doubt many of the work habits of students are built up rather early in life. I do not believe that the problem begins with the high school. Should it not be a part of the task of every teacher, especially in the elementary grades, to know something of the methods of study the pupils are employing? Were this important task begun rather early and then as soon as the proper time arrives, some formal instruction given in how to study, I believe that we could expect much better results from a large part of our teaching.

The colleges are as neglectful of the study problem as are any of the other educational institutions. Few of the higher institutions of learning have a course for their freshmen in how to study. I have become convinced that the students want to know what are the best methods of approach to their work. In one of my courses I require a review and criticism of certain books. I have listed among these works several dealing with habits of study. These are growing in popularity with the students. The statement I most often encounter is, "I should have read this book in my Freshman year." Some of the comments are rather pathetic. I quote one. "I have never read a book on the nature of how to use your mind before, much to my regret; and I fully realize the loss of these important facts in my Freshman year at college. The maxim 'Don't be a dead one' has haunted me since first I opened the book, for I know that opportunities pointing towards a Phi Beta Kappa key have passed quietly by me, unrecognized and unattempted. After I had completed the book I felt a great deal like—a hopeless sinner, who now determines to strike for the right path—and in my Junior year! Howeveer, I do not intend to assume the entire blame for this situation, since I was never taught how to study. I simply went at it in a haphazard way—due to the lack of proper supervision." Here is a student, who, I believe, could have raised her general scholastic standing had she been properly guided. No doubt a good student gets his lessons in spite of poor methods, but why should the good students be burdened with inefficient tools and why should the poor students be hindered by the lack of efficient methods of working? I believe that it is highly probable that many

of the B and C students could become A- or A in their scholarship, while many of the D students could lift themselves out of the mire of poor scholarship. Do not our educational institutions owe such an effort to the students? If we are to apply our psychology and attack the educational problem from the student's point of view, certainly the study problem offers a most excellent opportunity for such application.

# An Educational Survey Test

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GROUP tests of mental ability have now definitely found their place in the field of mental measurement. The mental survey is well established. It is the belief of the writers that we also need group tests for educational surveys to determine roughly general educational attainment just as the mental tests determine general mental ability.

We, therefore, need some kind of educational scale by means of which we can sum up a child's educational attainment in a single value, comparable with the value obtained by our mental tests. In order to do this we must have a selection of short educational tests which cover the main subjects that the school teaches. It is obvious that if we attempt to do this we shall have to base our result upon a careful selection of a few items out of the several standard school subjects, particularly if our test is to be of such a nature as to be given at one sitting.

More specifically the problem is to devise a short educational test covering the main subjects of instruction that can be given in about thirty or forty minutes. This test should include all the important subjects that are ordinarily taught in the elementary school. Recognizing, of course, that five to eight minutes' work on each subject cannot give us an accurate measure of an individual's attainment in each subject, such as we might obtain by devoting thirty to fifty minutes to each subject, there is, nevertheless, great practical need of a short scale covering the chief subjects that will give a fair measure of the general attainment of the individual and a good measure of the group. By means of this we can obtain accurate measures of different grades, of different schools and of different school systems.

The exercises in our Educational Survey Test were selected from the Standard Educational Tests and Measurements. The following criteria for selecting the examples were kept in mind and given consideration where they did not interfere with the value of the test. Except in comprehension tests in reading, those tests which

were expressed in the most easily and readily understood language were given preference. Those tests, which, according to the judgments of those selecting them and their experience with them, seemed to be most commonly successful and least subject to unfavorable external factors, were selected. Exercises were selected at approximately equal intervals along the range of the Standard Scales, so that the short test represented a graduation of difficulty comparable to that of the long scale. And, other things being equal, the tests which required a minimum of time and space in answering and consequently a minimum of time in grading, were chosen.

## THE TESTS.

### I. *Vocabulary*.. (Thorndike).

Look at the words below and write

The letter F under every word that means a Flower;
The letter N under every word that means a Boy's Name;
The letter B under every word that means a Book;
The letter G under every word that means good to be or do.

samuel, kind, lily, pansy, generous, modest, claude, courteous, merciful, reasonable, isaiah, chrysanthemum, considerate, reuben, ezra, ichabod, ledger, crocus, dahlia, jonquil, begonia, equitable.

### 2. Arithmetic. (Woody-Stone).

| | | | |
|---|---|---|---|
| 3×7= | Add<br>2<br>4<br>3<br>— | Subtract<br>13<br>8<br>— | Multiply<br>310<br>4<br>— |
| 1)1 | Subtract<br>50<br>25<br>— | Add<br>43<br>1<br>2<br>13<br>— | ¼ of 128= |
| Subtract<br>567482<br>106493<br>——— | Add<br>199<br>194<br>295<br>156<br>——— | 7/8×3/4= | .003).0936 |

If you buy 2 pencils for 7 cents each and a book for 65 cents. How much change should you receive from a two dollar bill?

Two girls receive $2.10 for making buttonholes. One makes 42 and the other 28. How shall they divide the money?

1/3+1/3= 7.3—3.00081= 9)69 lbs. 9 oz.

25.09+100.4+25+98.28+19.3614=

3. READING. (Kelly).

Answer these questions:

No. 1

The air near the ceiling of a room is warm, while that on the floor is cold. Two boys are in the room, James on the floor and Harry on a box eight feet high. Which boy has the warmer place?.....

No. 2

Think of the thickness of the peelings of apples and oranges. Put a line around the name of the fruit having the thinner peeling.

apples oranges

No. 3

If you would rather have a dollar than a little stone, do not put a line under dollar, but if you would rather have five dollars than a pencil, put a line under stone.

dollar stone

No. 4

Here are some names of things. Put a line around the name of the one which is most nearly round in every way like a ball.

saucer teacup orange pear arm

No. 5

I have five plums and Mary has four plums. Jane comes along and we see that she hasn't any. We want to divide with Jane in such a way that we shall all three have the same number. I gave Jane two plums. How many must Mary give her? .....

No. 6

Read these carefully:

Bears are larger than bugs.
Houses are larger than bears.
Mountains are larger than houses.
Then bugs are not as large as mountains.

I have tried to make no false statement among these four. If I have succeeded, underline the word success. If I have failed underline the word failure.

success failure

No. 7

It was a quiet, snowy day. The train was late. The ladies' waiting room was dark, smoky and close, and the dozen women, old and young, who sat waiting impatiently, all looked cross, low spirited or stupid.

In this scene, the women probably kept their wraps on, because they wished to be ready to take the train. Pretty soon the station agent came and put more coal in the stove, which was already red-hot in spots. Do you think this made the women happier? .....

No. 8

"Magnanimity in politics is not seldom the truest wisdom; and a great empire and little minds go together." (Burke)

Study Burke's quotation carefully. If he was in favor of territorial expansion as the goal of English politicians he was a standpatter. If he believed in the establishment of justice in human relations even at the sacrifice of territorial expansion, he was a progressive. Which was he, a standpatter or a progressive?

.....

4. READING. (Thorndike).

Read this and then write the answers. Read it again as often as you need to.

John had two brothers who were both tall. Their names were Will and Fred. John's sister, who was short, was named Mary. John liked Fred better than either of the others. All of these children except Will had red hair. He had brown hair.

1. Was John's sister tall or short?.....
2. How many brothers had John?.....
3. What was his sister's name?..'.....

Read this and then write the answers. Read it again as often as you need to.

Long after the sun had set, Tom was still waiting for Jim and Dick to come. "If they do not come before nine o'clock," he said to himself, "I will go on to Boston alone." At half-past eight they came bringing two other boys with them. Tom was very glad to see them and gave each of them one of the apples he had kept. They ate these and he ate one too. Then all went on down the road.

1. When did Jim and Dick come?.....
2. What did they do after eating the apples?.....
3. Who else came beside Jim and Dick?.....
4. How long did Tom say he would wait for them?.....
5. What happened after the boys ate the apples?.....

Read this and then write the answers. Read it again as often as you need to.

It may seem at first thought that every boy and girl who goes to school ought to do all the work that the teacher wishes done. But sometimes other duties prevent even the best boy or girl from doing so. If a boy's or girl's father died and he had to work afternoons and evenings to earn money to help his mother, such might be the case. A good girl might let her lessons go undone in order to help her mother by taking care of the baby.

1. What is it that might seem at first thought to be true, but really is false?
.....
2. What might be the effect of his father's death upon the way a boy spent his time? .....
3. Who is mentioned in the paragraph as the person who desires to have all lessons completely done?..'.....

5. COMPLETION. (Trabue).

Make good sentences. Write only *one* word on each blank.

1. We are going ..... school.
2. The sky ..... blue.
3. The ..... plays ..... her dolls all day.
4. Boys and ..... soon become ..... and women.
5. The poor baby ..... as if it were ..... sick.
6. She ..... if she will.
7. The poor little ..... has ..... nothing to .....; he is hungry.
8. A home is ..... merely a place ..... one ..... live comfortably.

9. To ..... many things ..... ever finishing any of them ..... a ..... habit.
10. The knowledge of ..... ..... use fire is ..... of ..... important things known by ..... but unknown ..... animals.
11. One ought to ..... great care to ..... the right ..... of ....., for one who ..... bad habits ..... it ..... to get away from them.

6. PUNCTUATION—GRAMMAR. (Starch).

Punctuate correctly:

1. We visited New York the largest city in America.
2. I like to work he said especially in the morning.

Cross out what is wrong, and leave the words so as to make a good sentence.

1. The paper reported (he; him) to be dead.
2. I can do it as well as (they; them).
3. The difference between summer and winter (is that; is) summer is warm and winter is cold.
4. I shall always remember the town because of (the good times I had; the good time) and the many friends I made there.
5. (Who; whom) do you mean?
6. A different set of knives and forks (was; were) put on the table.
7. (He sprang; springing) to the platform on which the dead man lay (and shouted; he shouted).

7. GEOGRAPHY. (Hahn-Lackey).

Answer these questions:

1. In what direction are you facing when your back is toward the north? .....
2. Name two other countries in North America besides the United States. .....
3. Name two large bodies of water that border on Florida. .....
4. What is the cause of day and night? .....
5. Name a mountain rainge and a river between Europe and Asia. .....
6. Give two reasons why cities usually grow up at falls in rivers. .....
7. What and where are the following:
   Nova Scotia .....
   Calcutta .....
   Good Hope .....
   St. Elias .....
   Moscow .....
8. Give one reason why Chicago rather than St. Louis has become the railroad center of the middle west. .....
9. Why does the southeast coast of Brazil get a comparatively heavy rainfall? .....
10. Why does the temperature often rise when snow begins to fall? .....

8. HISTORY. (Van Wagenen).

Answer these questions:

1. In what did the American Indian live?
2. Who was first President of the United States?
3. Name any American general.
4. Who was President of the United States during the Civil War?
5. Name any one of the battles of the Revolutionary War.
6. Name two purchases of land that have been made by the United States.

7. What were the first four nations to make settlements in America?
8. What public improvement was under construction during each of the following periods:
   1806-1814 .....
   1817-1825 .....
   1904-1914 .....
9. a. Who invented the telegraph?.....
   b. Who invented the telephone?.....
   c. Who laid the first successful Atlantic cable?.....
   d. Who wrote the Declaration of Independence?.....
   e. Who was Secretary of War during the greater part of the Civil War?....
10. In front of each of these questions below write the name of the President during whose administration the events took place.
   ..... War with Mexico?
   ..... Spanish American War?
   ..... Purchase of Florida?
   ..... Assertion of the Monroe Doctrine in the Venezuelan dispute?
   ..... Beginning of construction of Panama Canal?

The twenty-two words for measuring the vocabulary element in reading were selected from Scale A of Thorndike's Visual Vocabulary Scales,[1] at fairly equal intervals of difficulty from the least difficult to the most difficult. Two of the eighteen exercises in arithmetic were selected from the Stone Reasoning Tests. The remaining problems were taken from Woody's Arithmetic Scale[2]; five in addition, four in subtraction, four in multiplication, and three in division. They are arranged from the least to the most difficult, and represent, roughly, equal steps of difficulty as determined by Woody. Comprehension of meaning in reading is measured by two sets of exercises; the one taken from Kelly's Silent Reading Tests[3] and the other from the Thorndike Scale Alpha.[4] There are eight exercises in the former, and three exercises in the latter. The sentences for measuring language ability are from Trabue's Completion Test Language Scales.[5] The usage of Grammar is measured by two sentences from Starch's Punctuation Scale, and by seven sentences from his Grammatical Scale *A*.[6] The ten questions in

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[1]THORNDIKE, E. L. *The Measurement of Achievement in Reading; Word Knowledge.* Teachers' College Record. November, 1916.

[2]WOODY, C. *Measurements of Some Achievements in Arithmetic.* Teachers' College Contributions to Education. No. 80, 1916.

[3]KELLY, F. J. *The Kansas Silent Reading Tests.* Journal of Educational Psychology. Vol. VII. February, 1916. pp. 63-80.

[4]THORNDIKE, E. L. *An Improved Scale for Measuring Ability in Reading.* Teachers' College Record, November, 1915, and January, 1916.

[5]TRABUE, M. R. *Completion Test Language Scales.* Teachers' College Contributions to Education. No. 77. 1916.

[6]STARCH, D. *Educational Measurements.* Macmillan.

Geography show a fair sampling of the degrees of difficulty in the Hahn-Lackey Composite Scale[7]. The ten questions in History are from the Van Wagenen American History Scales, Information A and B. They represent an increasing range of difficulty.

These eight sets of exercises have been printed in booklet form with a view of economy of space and of convenience in giving, taking and scoring the tests. Half of page 1 contains blanks for the name, age, grade, and school of the pupil. On the other half the vocabulary test is so printed that the pupil must turn the page around in order to read the test. Pages 2, 3 and 4 follow page 1 as the right hand pages, always, of the booklet. Page five is the back of page 4 but printed in the reverse direction so that the pupil must turn the booklet around. With the booklet in this new position, pages 6, 7 and 8 follow as the right hand pages. Since the time element is very important in giving these tests, this arrangement makes the page opposite that one on which the pupil is working always reversed and thus prevents him from reading it. This saves his attention for the test on which he is working, and keeps him from becoming acquainted with another test outside the time allotted to it.

Since it was desirable to have the time limits for the tests short enough to prevent even the very brightest pupils from completing everything, the preliminary test sheets were given to a group of grade children and also to a group of college students, and records of the time required for each student for each test were kept. With these results as guides, one and one-half minutes were given for the Vocabulary test, five minutes for Arithmetic, two and one-half minutes for the "Kelly" reading, three and one-half minutes for the "Thorndike" reading, four minutes for language, one minute for Grammar, four minutes for Geography, and four minutes for History. This gives a total of twenty-five and one-half minutes. Allowing time for directing the pupils from one test to another, for writing their names, ages, grades, and schools on page 1, and for passing and collecting the papers, thirty minutes is sufficient for giving the entire set of tests to most of the grades, and perhaps thirty-five minutes for grades two and three.

It was one of the aims in constructing this series of tests to

[7] LACKEY, E. E. *A Scale for Measuring the Ability of Children in Geography.* Journal of Educational Psychology. Vol. IX. October, 1918.

reduce instructions to a minimum. No special instructions are necessary. The children are merely told to do what it tells them to do. The understanding of the very simple instructions printed at the beginning of each test may be assumed a prerequisite for the knowledge called for by the test.

In deciding the score values, the relative importance of the different subjects included in the tests was taken into consideration. About equal weight was given to Reading and to Arithmetic. History and Geography were weighted a little less and Grammar and Language combined again a little less. The difference in weight given to these subjects is, however, slight. The following table shows the method of scoring which was adopted:

| Tests | No. of Elements | Points for Each | Highest Possible Score |
|---|---|---|---|
| Vocabulary, | 22 | ½ | 11 |
| Arithmetic, | 18 | 2 | 36 |
| Reading K, | 8 | 2 | 16 |
| Reading T, | 11 | 1 | 11 |
| Language, | 11 | 1 | 11 |
| Grammar, | 9 | 1 | 9 |
| Geography, | 23 | 1 | 23 |
| History, | 24 | 1 | 24 |

By combining the three reading tests, and also the language and grammar tests, the highest possible scores rank the subjects in this order:

| *Subject.* | *Highest Possible Score.* |
|---|---|
| Reading | 38 |
| Arithmetic | 36 |
| History | 24 |
| Geography | 23 |
| Grammar and Language | 20 |
| Total | 141 |

By means of stencils and keys the test papers can be scored very rapidly.

After this much of the Test Construction had been completed a preliminary standardization of the work was attempted. The tests were given to 1,360 individuals in grades 2 to 8 inclusive, in high

school and in college. The results were scored and percentiles were calculated for the various ages and grades. The median percentile scores by ages and by grades are given in Tables I and II respectively.

TABLE I.

| Age, ..... | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | Adult |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Med. Score, .... | 2 | 2 | 12 | 20 | 32 | 38 | 41 | 49 | 48 | 55 | 72 | 80 | 109 |
| No Cases, .... | 6 | 143 | 154 | 177 | 208 | 196 | 162 | 124 | 84 | 49 | 18 | 11 | 28 |

Total, 1360

TABLE II.

| Grade, .. | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Median Score. .. | 3 | 13 | 25 | 36 | 47 | 61 | 67 | 77 | 76 | 75 | 83 | | |
| No. Cases, .. | 233 | 212 | 234 | 250 | 206 | 83 | 73 | 16 | 19 | 12 | 5 | Total | 1333 |

## A Comparison of the Abbreviated and Standard Forms

The next step consisted in establishing the reliability of the Abbreviated form by comparing the results obtained from it with the results obtained from the Standard Educational Measurements from which its tests were taken. In this process the long tests were given to as many pupils as possible who had taken the short forms. The children tested were from five different schools; a rather low grade city elementary school including all eight grades but in which only children from the sixth, seventh and eighth grades, took both tests; a grade school in a foreign district, but in which, however, the children were of about average mentality; a large grade school of medium standard including only the first six grades; the seventh and eighth grades in a village school; and the pupils in a rural high school. Grades 3, 4, 5, 6, 7, and 8 and the four years of high school were represented in the numbers who took the two forms of tests; altogether about 450 children, 247 taking both tests in vocabulary, 200 taking both in Arithmetic, 258 in Reading K, 270 in Reading T, 255 in Language, 208 in Grammar, 113 in Geography and 125 in History. The exact number, by classes and schools. tak-

ing each test can be seen by referring to Table III showing the coefficients of correlation.

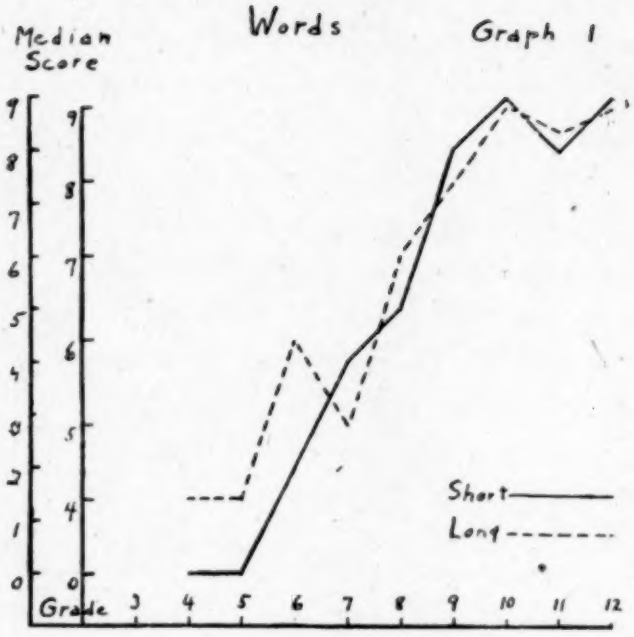
The distribution tables for the short and long forms are too lengthy to be printed here. A study of them shows on the whole that the short form distributes the cases fairly well. We must be content here with a study of the median scores for each grade. Graphs 1 to 8 show the rise of median scores from grade to grade on both the short and long forms of each test. The continuous line, in each case represents the short form, and the broken line, the long form. The more closely the two curves tend to take the same form and direction, regardless of the distance between the two lines the greater is the correlation between the short and long forms of the tests, as far as such correlation can be estimated from the central tendencies of groups.

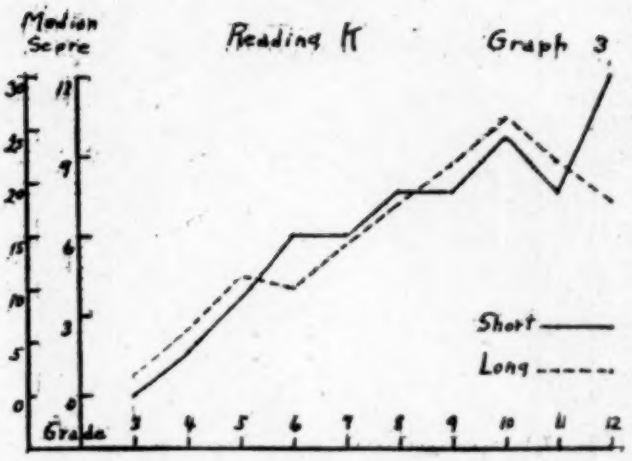
In most cases the curves agree fairly closely, this being particularly noticeable in Arithmetic, Reading K, Reading T and Trabue. We have hardly adequate data for this kind of a comparison on Geography. With History we have a close approximation except for the large divergence at Grade 11, which can be adequately accounted for by the very few cases tested.

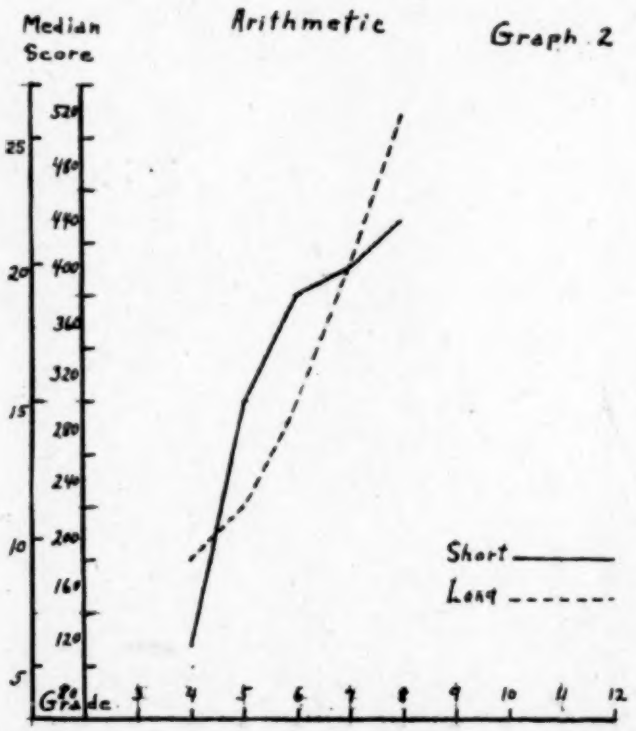
In all cases the greatest irregularities occur in grades nine, ten, eleven and twelve, that is, in the high school. This might be explained by either one of two factors. Such a small number of pupils was tested in each of these grades that the sampling is insufficient, or the fact that these pupils were tested in subjects with which they were all about equally unfamiliar and consequently a gradual increase in scores in these grades could not be expected. Grade 11 is consistently lower in practically all the tests and on both scales, which fact would seem to denote a general inferiority of that grade rather than a poor correlation of the one test with the other. Fair measures of high school pupils will have to be obtained by a test containing high school subjects.

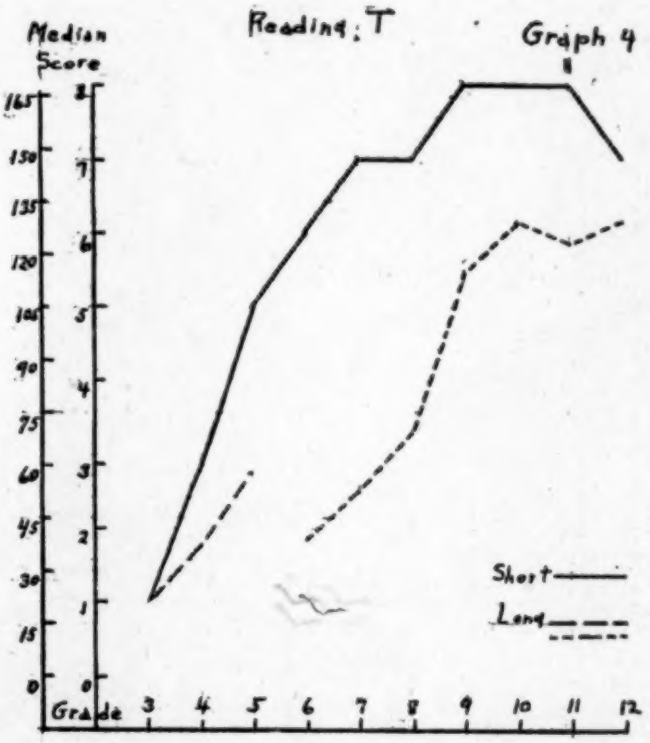
## Correlations of Homogeneous Groups

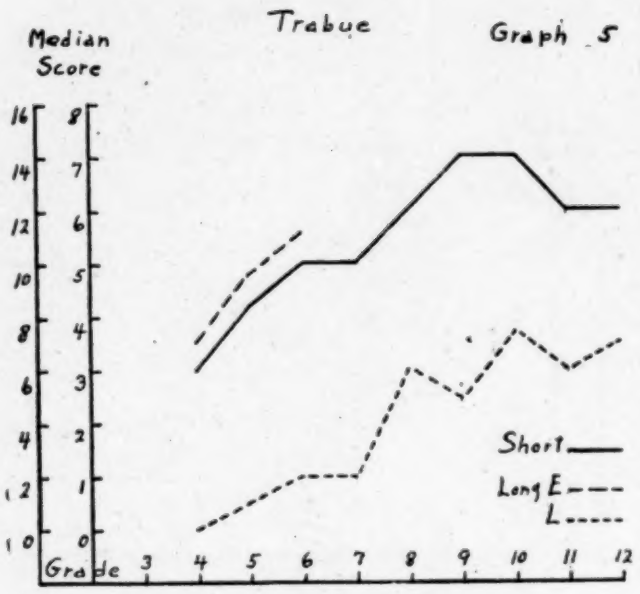
In working out the coefficients, each single class was first made a unit of comparison, except in a very few cases where the number in a class was too small to warrant getting a reliable coefficient, in which cases the small group was combined with another group near-

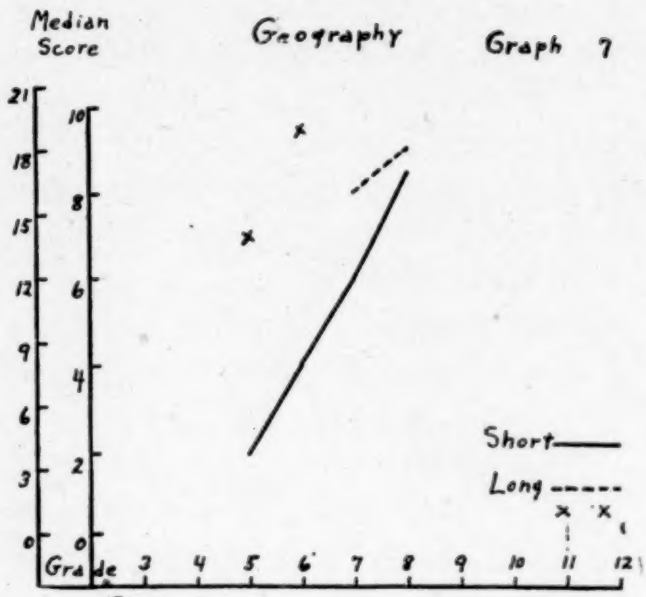

Median Score
Words
Graph 1
Grade
Short
Long

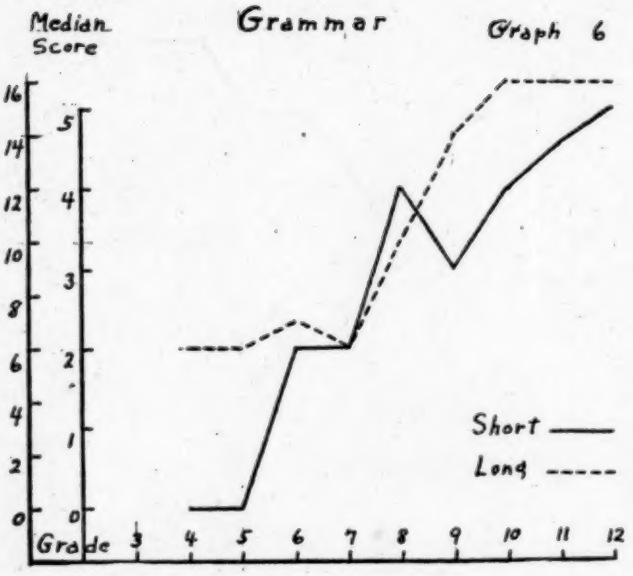

Median Score
Reading M
Graph 3
Grade
Short
Long

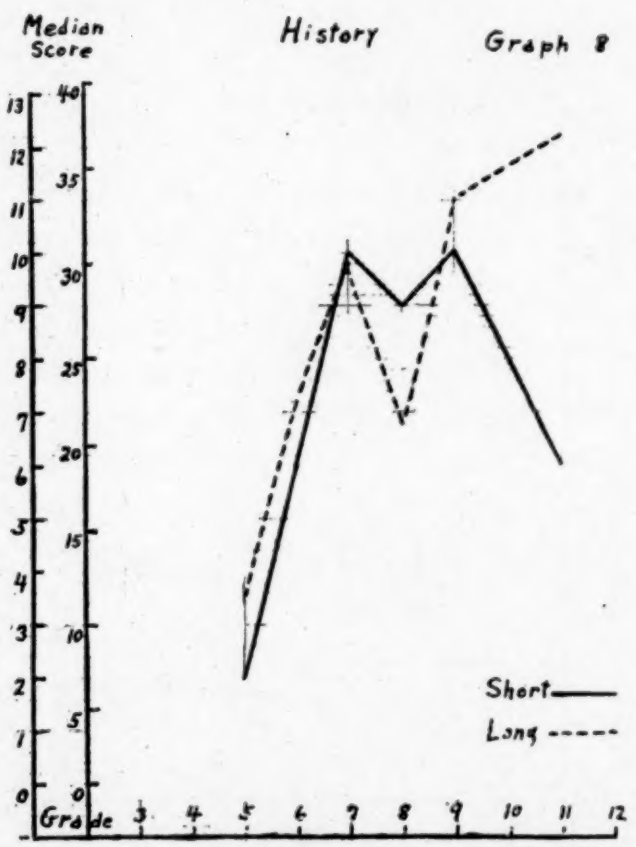

Median Score
Arithmetic
Graph 2
Grade
Short
Long


Median Score
Reading: T
Graph 4
Grade
Short
Long


Median Score
Trabue
Graph 5
Short
Long E
L
Grade


Median Score
Geography
Graph 7
Short
Long
Grade


Median Score
Grammar
Graph 6
Short
Long
Grade


Median Score
History
Graph 8
Short
Long
Grade

est like it, in the same school. The Spearman rank difference formula was used with these small homogeneous groups.

Table III gives the coefficients for each class in each school and for each of the tests. The numbers of cases used in each correlation are given in the column just preceding their corresponding coefficient. The averages of all the coefficients for each test have been found and are also presented in this table.

For the Vocabulary or Word's test, tes coefficients range from .24 to .74, with an average coefficient of .48. The coefficients for Arithmetic range from .19 to .78 with seven out of nine groups showing correlations above .40, five above .50 and four above .60. Reading K gives a range of .15 to .83. Eight out of the eleven classes give coefficients above .40, seven above .50, and five above .60. For Reading T, the range is from .11 to .86, with nine of twelve coefficients above .40, eight above .50 and five above .60.

TABLE III. COEFFICIENTS OF CORRELATION.

| School Grade | Words | | Arith. | | Read. K | | Read T | |
|---|---|---|---|---|---|---|---|---|
| | No. | r. | No. | r. | No. | r. | No. | r. |
| E. Col. 4, ..... | 19 | .64 | 18 | .19 | 16 | .71 | 14 | .76 |
| " " 5, ..... | 27 | .37 | 23 | .71 | 27 | .15 | 22 | .86 |
| " " 6, ..... | 29 | .40 | 25 | .56 | 21 | .48 | 21 | .53 |
| " " 7, ..... | 19 | .74 | 14 | .78 | 17 | .83 | 18 | .26 |
| " " 8, ..... | 15 | .24 | 13 | .47 | 9 | .54 | 9 | .55 |
| First Ave. | | | | | | | | |
| 3B ..... | | | 26 | .60 | | | | |
| " 3A " ..... | | | | | 32 | .66 | 30 | .66 |
| " 4B " ..... | | | 21 | .67 | 35 | .71 | 35 | .62 |
| " 4A " ..... | | | | | | | | |
| " 5B " ..... | | | | | 24 | .66 | 26 | .59 |
| " 5A " ..... | 32 | .66 | 31 | .35 | | | | |
| " 6B " ..... | | | | | 25 | .54 | | |
| " 6A " ..... | 27 | .39 | 29 | .48 | | | 27 | .47 |
| Fairfield H. S. ..... | 42 | .64 | | | 34 | .27 | 32 | .26 |
| W. Jeff. 7 ..... | 18 | .36 | | | | | 17 | .11 |
| W. Jeff. 8 ..... | 19 | .41 | | | | | 19 | .60 |
| Lane Ave. 7 ..... | | | | | 12 | .34 | | |
| Lane Ave. 8 ..... | | | | | | | | |
| Total, ..... | 247 | .59 | 200 | .56 | 258 | .65 | 270 | .77 |
| Average, ..... | | .48 | | .53 | | .51 | | .51 |

TABLE III (Continued).

| School Grade | Trabue No. | Trabue r. | Grammar No. | Grammar r. | Geography No. | Geography r. | History No. | History r. |
|---|---|---|---|---|---|---|---|---|
| E. Col. 4, .... | 13 | .34 | | | | | | |
| " " 5, .... | 23 | .57 | 31 | .09 | 30 | .55 | 30 | .55 |
| " " 6, .... | 21 | .42 | 26 | .36 | 26 | .50 | 18 | .87 |
| " " 7, .... | 17 | .66 | 21 | .90 | 21 | .62 | 19 | .62 |
| " " 8, .... | 8 | .17 | 12 | .17 | 12 | .69 | 11 | .43 |
| First Ave. 3B .... | | | | | | | | |
| First Ave. " 3A " .... | | | | | | | | |
| " 4B " .... | 36 | .51 | | | | | | |
| " 4A " .... | 31 | .30 | 25 | .48 | | | | |
| " 5B " .... | | | 24 | .38 | 24 | .41 | | |
| " 5A " .... | | | | | | | | |
| " 6B " .... | 24 | .55 | | | | | | |
| 6A .... | | | | | | | | |
| Fairfield H. S. .... | 33 | .26 | 34 | .41 | | | 11 | .89 |
| W. Jeff. 7 ..... | 17 | .41 | | | | | 17 | .57 |
| W. Jeff. 8 ..... | 19 | .60 | 35 | .52 | | | 19 | .81 |
| Lane Ave. 7 ..... | 12 | .60 | | | | | | |
| Lane Ave. 8 | | | | | | | | |
| Total, ..... | 255 | .55 | 208 | .44 | 113 | .55 | 125 | .50 |
| Average, ..... | | .45 | | .41 | | .55 | | .68 |

Trabue correlations extend from .17 to .66 with eight of twelve above .40 and six above .50. The coefficients in grammar range from .09 to .90; the four out of eight above .40, being .41, .48, .52 and .90. The geography coefficients run from .41 to .69; of the five coefficients, four are above .50 and two above .60. History correlations extend from .43 to .89. Of the seven classes compared six are above .50, five above .60 and three above .80.

The averages of all the coefficients for each test are shown in the last row of the Table. These average coefficients range from .41 (grammar) to .68 (history).

The next to the last row on the Table shows the correlation coefficients (Pearson's Product Moment) for all cases tested on both the long and the short scales. These larger and more heterogeneous groups show coefficients ranging from .44 (grammar) to .77 (reading T), denoting on the whole a very sensible degree of resemblance between the short and long scales.

In addition to this, comparisons were also made between several of the Long Scales with the total score of the Short form. The cases were ranked first according to the total scores for the short form, and then according to each of the scores for the long tests and the average of these ranks was found. This average rank represented the rank of the pupil on the long scale and was correlated with the rank according to the short form total score.

Twenty-four cases in a 5B class were used for comparing the total short form with the long scale, Reading Thorndike, Reading Kelly and Geography. The comparison showed a correlation of .716. The same cases, when the sum of the scores of only the Reading T, Reading K and Geography tests of the short form was compared with the sums of the scores of the corresponding long scales, gave .667.

Forty-three children in grades 5, 6, 7 and 8 took the short form and also the long scales, Visual Vocabulary, Arithmetic, Reading Kelly, Grammar and History. The average rank of these long tests was used with the rank according to the total score on the short form and a correlation coefficient of .84 was obtained.

Finally a comparison was made, using thirteen cases from grades 7 and 8, between all the long tests and the whole short form. The thirteen cases were the only ones in the entire number who had been tested, who had taken all the long tests and also the short form. The same rank method was followed here, and the correlation coefficient was .80.

It is reasonable to conclude, therefore, that a correlation of between 75 and 85 is very likely a true measure of the short form as compared with the several standard forms. The more of the latter that are used the closer will be the agreement with the rating of the short scale up to a certain point. The use of all the long standard forms will unquestionably give a more accurate pedagogical picture of a pupil than our shortened scale, but on the other

hand given only thirty minutes within which to sum up a pupil's pedagogical knowledge, the short form will be infinitely better than anything that could be achieved by any of the long forms within the same amount of time. Although several of the correlation coefficients are fairly low, we must remember that this is the case only when we compare each subject of the short scale. This is a very severe test of each particular part of the scale. Furthermore, comparing a more or less homogeneous group such as is contained in any one grade, we hereby increase considerably the severity of the test. Remembering these things, it is surprising and gratifying to find the short form always giving positive and nearly always giving reasonably high coefficients. Since, however, in actual practice the short scale will always be used as a whole and never in parts we may conclude that it will give us a fairly good measure of an individual and a very good measure of a grade and unquestionably as accurate a measure of a whole school as could be obtained by the use of several long scales involving days and days of testing.

On the other hand, it is not intended for use by the teacher who is seeking detailed and accurate knowledge of her pupil's ability in any one subject or who is planning to use Educational Measurements for diagnosing the particular difficulties and weaknesses of her students.

## Conclusions

1. The shortened form of the standard educational measurements gives correlation coefficients ranging from .41 to .68 when the separate tests in the scale are compared with the corresponding long scales from which they were derived. The inference from this fact is that the separate parts of the short scale are reliable measures of attainment in the separate subjects which they attempt to measure, and that fairly good results will be obtained if the object is to ascertain individual differences in the separate school subjects. At least the results will indicate where further investigation would be necessary or profitable.

2. When the total result of the short form is compared with the total of the results of the long scales a coefficient of about .786 is obtained, indicating an excellent correlation. This means that prac-

tically the same results will be obtained by the use of the short form as by the use of the separate long scales, if a measure of general attainment is desired.

3. The short form represents economy in time, labor and cost. The following table shows the time required to give and score both the long scales and the short form for one class of thirty pupils.

Long Scales.

| Scale | Mins. Required to Give | Mins. Required to Score |
|---|---|---|
| Words, | 20 | 20 |
| Arithmetic, | 80 | 240 |
| Reading K, | 5 | 30 |
| Reading T, | 30 | 45 |
| Trabue, | 7 | 30 |
| Grammar, | 15 | 30 |
| Geography, | 30 | 60 |
| History, | 45 | 45 |
| Total, | 232 | 500 |

Total (giving and scoring) 732 minutes=12+ hours.

Short Form.

| Scale | Mins. Required to Give | Mins. Required to Score |
|---|---|---|
| Total, | 30 | 30 |

Total (giving and Scoring) 60 minutes=1 hour.

This shows a saving of eleven hours time for every class of thirty pupils tested by the short form. In a single school of twelve such classes the saving of time would amount to one hundred and thirty-two hours, and in a school system of five such schools, the saving would amount to six hundred and sixty hours. This economy of time represents the same economy of labor. The economy in cost is evident also, both in the cost of labor and of test material.

4. The short form makes possible greater efficiency in administration and supervision, for it includes in a single value the measure of the pupil's attainment in general education and puts it on a comparable basis with his measure of capacity in general intelligence.

# Results of the Bell Chemistry Test

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*Teachers College, Columbia University.*

LATE in March, 1920, the Bell Chemistry Test[1] was given to 27 pupils in the Reading, Pennsylvania, Boys' High School, and to 11 pupils in the Horace Mann High School for Boys, of Teachers' College, Columbia University. As an addition to Bell's tentative standards, the results are here reported in Table 1.

TABLE I.

Showing the Scores in Bell Chemistry Test for 38 Boys, March, 1920.

| Score | Number of Pupils Reading | Horace Mann |
|---|---|---|
| 41, ..... | 1 | |
| 44, ..... | 1 | |
| 46, ..... | 1 | |
| 48, ..... | 2 | |
| 53, ..... | 1 | |
| 54, ..... | 1 | |
| 55, ..... | 2 | |
| 56, ..... | 4 | |
| 57, ..... | 2 | |
| 59, ..... | 3 | |
| 60, ..... | 2 | |
| 61, ..... | 3 | |
| 63, ..... | | 1 |
| 66, ..... | 1 | |
| 67, ..... | | 1 |
| 70, ..... | | 1 |
| 71, ..... | 1 | |
| 75, ..... | | 2 |
| 77, ..... | 1 | |
| 82, ..... | | 1 |
| 85, ..... | | 2 |
| 88, ..... | | 1 |
| 89, ..... | 1 | 1 |
| 91, ..... | 1 | 1 |
| Totals, ..... | 27 | 11 |
| Median, ..... | 57.25 | 82.5 |
| Average, ..... | 57.96 | 79.09 |

Although the pupils tested had studied chemistry for only a little over six months, their scores compare favorably with those of the Texas pupils who had pursued the subject for eight months. This

1 Journal of Educational Psychology, Vol. 9, 1918, 199.

suggests that Bell's tentative scores may be low. The list should be applied to a number of other pupils in different states.

In order to secure some measure of reliability of the test, correlations were made between the scores, the marks of the pupils in chemistry for the first semester, and the estimates by the teachers of the pupils' knowledge of chemistry at the time the list was given. The correlations between the last two items are of course spurious, as the ranks come from the same source; but they serve to indicate something of the unreliability of teachers' judgments. The results are shown in Table II, the P. E.'s being given in parenthesis. As not all of the pupils considered received three marks, the numbers involved vary slightly.

TABLE II.

Showing the coefficients or correlation $[\rho = 1 - \frac{6\Sigma d^2}{n(n^2-1)}]$ between scores in the Bell Chemistry Test, Semester Marks, and Teachers' Estimates of the Pupils' Knowledge of the Subject.

| | Marks | Teachers' Estimates | | Marks | Teachers' Estimates |
|---|---|---|---|---|---|
| Test | .300 (P.E. .214) | .388 (P.E. .197) | .414 (P.E. .117) | .352 (P.E. .126) | |
| Marks | | .557 (P.E. .121) | | .871 (P.E. .029) | |

These raw coefficients may be interpreted as showing that the test is a fairly good measure of a class knowledge of chemistry; but a study of the detailed pairings indicate that it is unreliable for an individual. Satisfactory high relationship between the results of the test and teachers' marks can not be expected when the coefficient between a teacher's marks and estimates runs as low as .56.

As in the original article Bell did not give a scoring sheet and as that used in Texas has been lost, one prepared by Mr. Robert F. Payne is appended for the convenience of others desiring to use the test.

### Bell Chemistry Test

1. What chemicals are liberated in the electrolysis of water?
2. What gas is given off by the action of yeast in bread dough?
3. Name two chemicals used in making oxygen.
4. Express in cubic centimeters, one liter.
5. Name two substances used in making hydrogen.
6. Define oxidation.

7. Define reduction.
8. Name four processes of purifying water.
9. What is a deliquescent substance?
10. Name two gases either of which might be used to bleach cloth or flowers.
11. Name two very common organic acids.
12. Name two chemical compounds used in making common salt.
13. Write the reaction for sulphuric acid on potassium hydroxide.
14. Name the two most abundant elements in the atmosphere.
15. Name two commercial sources of ammonia.
16. Is air a chemical or a physical mixture?
17. Why does ammonia water always feel cold when it comes in contact with the hands?
18. Name the substances used to make aqua regia.
19. Name four basic hydroxides.
20. Name the commercial uses of the nitrates.
21. What are the properties of carbon bisulphide?
22. Give the chemical name of: $CaSO_4$..... $H_2S$..... $Na_2SO_3$.....
23. What is the calence of: H....., O....., Ca....., $SO_4$.....
24. Name the members of the Chlorine group.
25. How many grams of water are formed by the combustion of 10 grams of hydrogen in air?

### Correction Sheet for Bell Chemistry Test

Allow 4 credits for each correct answer. 1, 2, or 3 credits for partially correct answers. Avoid fractional credits by marking to the nearest full unit.

| *Possible Credit* | *Question* | *Answer.* |
|---|---|---|
| 4-2-0 | 1 | Hydrogen and oxygen. $H_2$ & $O_2$, H & O. |
| 4-0 | 2 | Carbon dioxide. $CO_2$ |
| 4-2-0 | 3 | Potassium chlorate, Manganese dioxide, Mercury oxide, Barium oxide. (Any two.) |
| 4-0 | 4 | One thousand cubic centimeters. 1000 cc. |
| 4-0 | 5 | Zinc or Iron and Sulphuric acid. (Any common acid.) Sodium or Potassium and water. (Also accepted.) |

| | | |
|---|---|---|
| 4-0 | 6 | Oxidation is the combining of oxygen with an element or compound.<br>Oxidation means increase in valence. (Also accepted.) |
| 4-0 | 7 | Reduction is the taking away of oxygen from a compound.<br>Reduction means decrease in valence. (Also accepted.) |
| 4-3-2-1-0 | 8 | Filtration, boiling, freezing, distillation, sedimentation, chemical treatment. (Any four.) |
| 1-2-0 | 9 | A deliquescent substance is one that absorbs moisture from the air (2 point credit) to such an extent as to become liquid. (Full credit.) |
| 4-3-2-0 | 10 | Chlorine, Sulphur dioxide,—*Nascent* or *atomic* Oxygen. (For failure to specify nascent or atomic deduct one point credit.) (Any two.) |
| 4-2-0 | 11 | Acetic, tannic, citric, lactic, oxalic, etc. (Any two.) |
| 4-0 | 12 | Sodium hydroxide and Hydrochloric acid. |
| 4-0 | 13 | $2KOH + H_2SO_4 \longrightarrow K_2SO_4 + 2HOH$. (No deduction for failure to balance equation.) (Word equation accepted.) |
| 4-2-0 | 14 | Nitrogen and Oxygen. |
| 4-2-0 | 15 | From distillation of soft coal. Direct union of nitrogen and hydrogen by electricity. |
| 4-0 | 16 | Physical. |
| 4-0 | 17 | Because the rapid evaporation takes up heat. |
| 4-0 | 18 | Nitric and Hydrochloric acids. (No credit unless both are correctly given.) |
| 4-3-2-1-0 | 19 | Sodium hydroxide, Potassium hydroxide, Ammonium hydroxide, Calcium hydroxide, Aluminum hydroxide, etc. (Any four.) |
| 4-2-0 | 20 | Fertilizers and Explosives. |
| 4-3-2-1-0 | 21 | Volatile liquid—strong odor—slight yellow in color—good solvent for many substances—somewhat inflammable. |

| | | |
|---|---|---|
| 4-3-2-1-0 | 22 | $CaSO_4$...Calcium Sulphate. $H_2S$...Hydrogen sulphide. $Na_2SO_3$...Sodium sulphite. |
| 4-3-2-1-0 | 23 | Valence: H...One. O...Two. Ca...Two. $SO_4$...Two. |
| 4-3-2-1-0 | 24 | Fluorine, Chlorine, Bromine, Iodine. (No deduction for failure to *rename* Chlorine.) |
| 4-0 | 25 | 90 grams. |

# The Journal of Educational Psychology

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## EDITORIAL

FOR the past ten years the dull or backward child has received a great deal of attention from school authorities. The study of age—grade tables has revealed his numerical frequency, and the judgment of teachers supported by the Binet and other tests has picked him out individually. He has been specially classified in small, selected classes, he has been given exceptionally well trained and highly paid teachers, and no effort has been spared to give him the education of the normal child. The results from an educational point of view are far from satisfactory. With the greatest trouble and effort he masters only a fractional part of the normal course of study, and as soon as he escapes from the school environment he forgets practically all he has learned. The simple manual occupations which he can learn may serve to keep him busy, but usually are of little value

*The Gifted Child*

for a productive livelihood. So great is the discrepancy between effort expended and value received, that many are beginning to question the advisability of trying at great cost to educate the natively ineducable, and to urge concentration of attention upon more promising material.

It is now pretty generally admitted that the gifted child in our public schools has been neglected. Terman declares that no child in the schools is so seriously retarded as the gifted child. One reason for this is the wide-spread popular belief that precocity in childhood presages stupidity in later life. Many parents deliberately try to retard their bright children in order to lay a better foundation, as they think, for future success. Intellectual measurements show that this view is entirely fallacious, that the intelligence quotient is practically constant, at least through adolescence, and that, other things being equal, no harm can come from the judicious encouragement of native aptitudes. Another reason for the neglect of the bright child is the commonly accepted doctrine of teachers that he does not need any special attention, that he will always be able to look out for himself. In a certain sense this, of course, is quite true. With ordinary attention to class work and with a reasonable amount of application the bright child will surpass the median of the class, and will do more than meet the general requirements for a passable standing. But to rest content with this spells retardation, for the superior native capacities of the bright child demand higher standards of expectation than those set for the average of the class.

This brings us face to face with an important question of educational policy. In the past the public school has rather prided itself upon the application of a single standard to all pupils. This standard was necessarily an average one, or one which a large majority of the pupils could be expected to attain. In other words the whole effort of the school was directed to the attainment of mediocrity. This was defended in the name of democracy, and the single standard public school was lauded as the bulwark of democratic ideals. But does not modern democracy call for more than mere mediocrity? Does it not demand a recognition of individual differences, and the utmost development of each individual's potentialities? If this is so, the single standard, the uniform course of study will no longer suffice. Not only must we have different requirements for

different groups of pupils, but each individual must be considered in the light of his potential contribution to society. The child who is especially gifted in music or drawing or playing baseball should have a special curriculum constructed for him, emphasizing those activities which will contribute to the development of his gift, and minimizing work in arithmetic, spelling, handwriting and other subjects which are of little value to him or to society.

J. C. BELL.

# NOTES AND NEWS

An extensive investigation to determine whether there is any effect of tobacco upon the intellectural processes is being conducted under the direction of Professor M. V. O'Shea, of the University of Wisconsin. Several lines of investigation are being pursued. Experimental work in the psychological laboratories of the University of Wisconsin was begun last June and will continue for many months to come. This work is in immediate charge of Dr. Hull, who has charge of experimental psychology in the University, aided by a number of assistants. A technique has been worked out for this investigation which eliminates the factor of suggestion and enables the investigators to study the effect of tobacco alone. In addition to the laboratory investigations the records of a large number of pupils who smoke in high schools and colleges is being compared with an equal number of non-smokers. The records are transcribed beginning several years before the smokers began smoking and are brought down to the present time so that if any influence is exerted by tobacco it can be traced through a number of years. Data concerning other factors which might influence scholarship in the case of each pupil are secured and it is expected that it will be possible to determine the effect of tobacco as distinct from all other factors.The principals and superintendents and directors of research in a number of cities throughout the country are coöperating in securing data for this phase of the investigation. Other lines of study are being carried on, all of which are designed to obtain data supplementary to the laboratory studies and investigation of the scholastic records. The physiological effects of tobacco are being investigated by Professor Cannon, of the Harvard Medical School; Dr. Hooker and Professor McCollum, of Johns Hopkins University; Professor Erlanger, of Washington University; Professor Martin, of Stanford University; and Professor Brooks, of New York University. Professor Farnam, of Yale University, is studying the economic aspects of the tobacco problem.

The Pennsylvania Special or Fitting Class Act, passed last year, provided for the physical and mental examination of all children between the ages of eight and sixteen who are seriously retarded in their school work or who fail to profit by the ordinary school instruction. Special education is to be provided for such children, the state appropriating one-half the cost. The Mental Hygiene Committee

of the Public Charities' Association is conducting an active campaign for the enforcement of the law, and under the leadership of Dr. Norbert Melville, is endeavoring to arouse the public to the importance of this work for public education.

Dr. Paul R. Stevenson, director of the Bureau of Research, University of Omaha, has devised an Omaha Group Test of Intelligence. The series consists of eight tests containing from five to fifteen exercises each. The tests are likeness and difference discrimination, correction of statement, arithmetical problems, disarranged sentences, following directions, synonyms—antonyms, analogies, and range of information. The series requires only twenty minutes to give and is intended for use in grades three to eight and in the first year in the high school. A feature of the directions to each test is the omission of one or more crucial words which are to be written in at the dictation of the examiner, thus preventing any pupil working ahead. Tentative norms are indicated in a folder accompanying the tests.

The March meeting of the New York Society for the Experimental Study of Education was devoted to the consideration of "Problems in the Standardization of Penmanship Teaching." Mr. Clyde C. Lister described the "Steps Toward Standardizing the Teaching of Penmanship in New York City Schools"; Mr. Eugene A. Nifenecker gave an account of an investigation in representative elementary schools to establish norms of accomplishment for the different grades on the basis of the New York City Penmanship Scale; Miss Lizzie E. Rector spoke on "Standardization as an Aid in Teaching Penmanship"; and Mr. Morgan J. Goldsmith emphasized "The Need of Standardization in Penmanship."

At the meeting of the New York Branch of the American Psychological Association, at Columbia University, on March 1, the following papers were presented: "Responses of Sane and Insane to the Ball-and-Field Test," Professor L. S. Hollingsworth; "The Intelligence of Troops Infected with Hookworm," Dr. Garry C. Myers; "Should Teachers Use the Stanford Revision? A Discussion of Terman's 'Intelligence of School Children,'" Dr. Francis N. Maxfield.

The Seventh Annual Conference on Educational Measurements will be held at Indiana University, April 23 and 24. The principal speakers from abroad will be Professor E. L. Thorndike, of Colum-

bia University, and Professor C. E. Seashore, of the University of Iowa. Professor Thorndike will speak on the following topics: "Measuring Educational Forces," "The Danger of Indiscriminate Use and Misuse of Educational Tests," "The Task of the Elementary School," "The Use of Intelligence Examinations for College Entrance," and "The Standardization of Textbooks." Professor Seashore will give two addresses: "The Analysis of the Musical Mind for the Purpose of Rating," and "The Discovery and Encouragement of Musical Talent in the Public Schools by Means of Measurement." Other papers will be: "The Relation between Intelligence and Achievement in the Second Grade," by Mrs. Sidney L. Pressey; "A Symposium on Educational Research," directed by Professor H. G. Childs; "A State-wide Mental Survey of High School Seniors in Indiana," by Professor W. F. Book; and "Needed Modifications in the School Curriculum and Standard Tests," by Professor W. W. Black.

Beginning with the May number *The Educational Review* will be under the editorship of Dean Frank P. Graves, of the school of education, University of Pennsylvania.

Mr. Robert H. Lane, of the Department of Educational Research, Los Angeles Public Schools, has been made assistant superintendent.

Lieutenant Schachne Isaacs, psychologist in the Air Service, Medical Research Laboratory, Mitchell Field, Long Island, has been awarded the fellowship in psychology offered by the Society for American Fellowship in French Universities.

# PUBLICATIONS RECEIVED

ELLWOOD P. CUBBERLEY. *Public Education in the United States.* Boston: Houghton Mifflin Company, 1919. Pp. xxvi, 517. $1.80.

This is a history of education in America, yet much more than a mere history of education. It is also a survey of present tendencies in education, and an evaluation of the forces that are making themselves felt along new lines. Indeed the book might well be called a discussion of contemporary education in its historical setting. This is no chance product of professorial inspiration, but, as the author indicates in the preface, it is a deliberate effort to meet the criticism that the traditional history of education fails to function, and to present something that will have vital and manifold points of contact with present problems. The first four chapters deal with the earlier influences in American education; the next three describe the great battle for free, state-supported schools; chapters 8, 9, 10, and 11 discuss the new ideas in education since 1860; while the remaining four chapters deal with such topics as differentiated courses of study, education of defectives and delinquents, child welfare, vocational education, the scientific movement in education, reorganization of the high school, Flexner's "Modern School" proposal, consolidation of rural schools, and the present trend toward the nationalization of education. It is masterful book and packed from cover to cover with good things forcefully stated.

JUNE E. DOWNEY. *The Will-Profile: A Tentative Scale for Measurement of the Volitional Pattern.* University of Wyoming Bulletin, Vol. 15, No. 6A, 1919. Pp. 38.

This is an interesting attempt to work out a scale for those forms of behaviour that give indications of the mechanism of conscious control. There are ten tests in the scale. 1. Checking of paired traits to express individual judgment of one's own character. 2. Writing own name under four different control conditions. 3. Choosing one of two sealed envelopes, each of which contains directions for a mental test, the one hard, the other easy. 4. Writing a phrase as quickly as possible on a line of given length. 5. Writing the same phrase under varying conditions. 6. Disguising handwriting, first by changing either slant or size, second in any other way without modifying slant or size. 7. Imitating a model, first as

rapidly as possible, second as exactly as possible. The same with a second model. 8. Writing name under four different types of distraction. 9. Resistance to suggestion (about envelope chosen in 3). 10. Blocked writing. Elaborate directions are given for scoring the tests, and sample will-profiles are presented from a collection of over two hundred.

CHARLES A. ELLWOOD. *Sociology and Modern Social Problems.* New Edition. Cincinnati: The American Book Company, 1919. Pp. 416.

This discussion of social problems is based on the nature of the family and its wide-spreading relations. The first three chapters are introductory, and deal with the study of society and the bearing of the theory of evolution and of modern psychology upon social problems. Chapters four to eight treat of the family proper, its function, origin, forms, historical development, and the problems of the modern family. Later chapters discuss the growth of population, the immigration problem, the negro problem, the problem of the city, poverty and pauperism, crime, socialism, education and social progress. It is a very readable book, and deserves wide circulation among teachers.

GUY G. FERNALD. *The Defective-Delinquent Class: Differentiating Tests.* Second Edition. Reprinted from American Journal of Insanity, April, 1912. Pp. 523-592.

It is significant of the interest in mental tests that Dr. Fernald has found it desirable to have another reprint made of his article of eight years ago. Of the twelve tests tried in this series the following six were retained as significant: Weight discrimination, ethical dscrimination, achievement capacity, extent of movement, ethical perception, and calculation. There is a tabulation of the results of these tests on one hundred delinquents and a history of each case.

*Fifth Conference on Educational Measurements.* Indiana University, Bloomington, Indiana. December, 1918. Pp. 140.

The principal speakers at this conference were Professor Guy M. Whipple and Professor Edward L. Thorndike. Professor Whipple spoke on the following topics: "The Problem of Selecting and Training Gifted Children in the Public Schools," "Some Further Possibilities of Mental Testing," and "The Development of Methods of Group Examination of the Intelligence of Adolescents." Pro-

fessor Thorndike discussed "Tests for Vocational Selection," "Application of Vocational Tests to Present School Problems," and "Recent Developments in Educational Measurements." Dr. Sidney L. Pressey explained "A Systematic Plan for Selecting Subnormal and Supernormal Children in the Public Schools" and Professor W. F. Book spoke on "Variations in Mental Ability and Its Distribution Among the School Population of an Indiana County."

JESSE KNOWLTON FLANDERS. *Mental Tests of a Group of Employed Men Showing Correlations with Estimates Furnished by Employer.* Reprinted from The Journal of Applied Psychology, Vol. 2, 1918, 197-206.

Forty-seven employes of an express company were tested by the Stanford-Binet tests, and the result correlated with school grades completed, occupational status of father, salary, intelligence rating by superiors, accuracy, all-round efficiency, length of service, speed, age, cooperativeness, dependability, and loyalty. The ratings in many of these were based on the combined judgments of three superiors. The correlations were very low, the highest being with school grades completed, .44.

W. H. FLETCHER. *Concrete Geometry in the Junior High School.* Reprinted from School Review, 27:1919. 441-457.

A description of a course in concrete geometry as it is presented in the seventh grade of the training school of the Oshkosh State Normal School. Construction of figures plays a large part in the course.

GUSTAVE GELEY. *De L'Inconscient au Conscient.* Paris: Librairie Felix Alcan, 1919. Pp. xiii, 346. 11 fr.

This is a courageous attempt to develop a philosophy of the individual based on the analysis and synthesis of all the principal facts of the natural sciences, biology, physiology, and psychology. The first part of the book is critical, and attacks current conceptions of evolution, of the physiological individual as a complex of cells, and of the psychological individual as a summation of conscious neurones. The essence of the psychological individual is the subconscious. The author does not believe in the vitalism of Bergson, but assumes what he calls "an essential dynamo-psychism," or blind vital urge, which by a hierarchy of representations mutually conditioning each other develops into the conscious individual. These representations, according to the author, are shown by the phenom-

ena of the subconscious to be different from the individual itself, superior to the organism, conditioning it but not conditioned by it. They are the direct result of the creative dynamo-psychism. What a dynamo-psychism is, how it could create such things as representations, and how these representations could constitute an individual, are problems for the solution of which the reader is referred to the arguments of the book.

ARNOLD GESELL. *What can the Teacher do for the Deficient Child?* Connecticut State Board of Education, 1918. Pp. 47.

This little brochure is presented as a brief manual of explanations and suggestions concerning extremely backward children in rural, village and city schools who cannot have the benefit of training in a special class. It contains a primer of questions and answers on mental deficiency, illustrative cases of deficient school children, and suggestions for a special program for the deficient child.

HENRY H. GODDARD. *Psychology of the Normal and Subnormal.* New York: Dodd, Mead and Company, 1919. Pp. xxiv, 349. $5.00.

This is a very stimulating book, both on account of the nature of some of the positions taken, and on account of the clearness and definiteness which characterize the discussion. The author insists that psychology is the science of mind, and that mind determines human conduct. This would seem to exclude him from the new behaviorist school, and group him with the introspectionists. This, however, would be directly contrary to the entire trend of the argument. In no textbook in psychology will there be found more numerous diagrams of the elements of the nervous system. The entire account of mental life is couched in neural terms. Even in the consideration of such topics as attention, association, and thinking there is little reference to introspection, and great stress is laid upon the study of objective behavior. The great advances in modern psychology, says the author, are found not in the laboratories for adult human psychology, but in the study of animal behavior, in child-study, and above all in the study of the behavior and the neural organization of the feeble-minded. One of the most significant arguments developed in the book is the view, first advanced by Mosso, that the emotions depend primarily upon the sympathetic nervous system, and are brought under control only through the interaction of the sympathetic and the cerebro-spinal systems. This view is supported with great skill by citations from the recent studies of Cannon on the physiology of the emotions.

SAMUEL HAMILTON. *Essentials of Arithmetic.* Cincinnati: American Book Company, 1919. First Book, Pp. 368. Second Book, Pp. 432.

The author's aim in these texts is to give the pupil such a mastery of number combinations and processes as will enable him to perform with accuracy and speed all common numerical operations, and to train him in the skillful application of these processes to the problems that he is likely to meet in his daily experiences.

SAMUEL P. HAYES. *Report of a Preliminary Test of the Reading of the Pupils of the Pennsylvania Institution for the Instruction of the Blind at Overbrook, Pa.* Published by the Institution, 1918. Pp. 20.

This is a study and analysis of the rate at which blind pupils read, a search for the factors involved in failure or success in reading, and an establishment of tentative standards of reading rate for different grades and years of experience with Braille. The Courtis Standard Silent Reading Tests were printed in Braille and given to 103 blind pupils. There was a wide range of reading rate, the speediest reading more than ten times as many words per minute as the slowest. The median was 62 words per minute, which is not more than one-third as fast as seeing children of the same ages. There is an interesting analysis of the mechanics of touch reading with the promise of more detailed experimentation later. Practice and mentality are the chief causes for the differences in attainment shown.

PIERRE JANET. *Les Medications Psychologiques. Etudes historiques, psychologiques et cliniques sur les methodes de la psychotherapie.* Paris: Librairie Felix Alcan, 1919. Two volumes. Vol. I. *L'Action morale, l'utilisation de l'automatisme.* Pp. 346. 13.20 fr. Vol. II. *Les Economies psychologiques.* Pp. 308. 13.20 fr.

These two volumes contain the lectures delivered by the author at Harvard University in 1904-06 and at the College de France in 1907. The first volume presents studies in so-called mental healing, including miraculous religious cures, the practices of Christian Science, and the methods of various faith healers. The second part of this volume is a discussion of hypnosis, suggestion, and the appeal to the automatic in the treatment of disease. There is a historical discussion of hypnotism in which the differences between the author's theories of hypnosis and those of Bernheim of Nancy

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# The Journal of Educational Psychology

C. E. SEASHORE
C. H. WHIPPLE

[illegible] ASSOCIATE EDITORS

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are set forth. A more precise definition of suggestion is then developed, the conditions of suggestion are discussed, and the relation of suggestion to hypnotism is considered. In the second volume various aspects of the rest cure for nervous diseases are discussed, the methods of isolation and their effects are considered, and the procedures of the psychoanalysts and the re-educationists are evaluated. While the lectures were originally prepared fifteen years ago, some account is taken of the more recent discussions in the fields considered.

W. Franklin Jones. *A Study of Handedness.* Vermillion, S. D.: University of South Dakota, 1918. Pp. 80.

The problems underlying this investigation are (1) How can we determine whether a child is born right or left handed? (2) How can we distinguish born handedness from acquired handedness? (3) Should the lefthanded child be "transferred" to the right hand? The author answers the first two questions as follows: "Born handedness is revealed by the measures of the bones of the arm, the major arm having the larger bones; adopted handedness is shown by the muscle swell, the adopted, or preferred, arm having the higher percentage of muscle swell. These conclusions rest upon the arm measurements of twenty thousand individuals. Detailed tables are given of the measurements of 200 right-handed persons, 40 left-handed persons, and 60 "transferred" persons. Ninety-six per cent. of the human race are born right-handed and four per cent left-handed. Seventy-seven per cent of all born left-handers are "transferred" to the right hand. One-half of all stammerers are "transfers," and one-third of all left-to-right "transfers" are stammerers. Hence it would seem that the process of "transfer" brings about a disorganization of the nervous system which is apt to show itself in speech disturbances.

William A. Locy. *The Main Currents of Zoology.* New York: Henry Holt and Company, 1918. Pp. vii, 216.

The ordinary treatise on zoology gives a great many facts about animals, their classification, their structure, their habits, and so on, but there is little opportunity for the student to appreciate the general significance of the subject and its bearing upon social life. In order to comprehend zoology in the light of its progress, it is necessary to trace its main currents. The present book is intended as collateral reading for courses in practical biology, but also it will enable the general reader to appreciate something of the importance of zoology for the general affairs of life.